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The Generic Relationships of the Family Pyemotidae (Acarina: Trombidiformes)[1]

BY

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ABSTRACT: The tarsonemine family Pyemotidae includes a group of over a hundred and twenty known forms, some of which are of medical or agricultural importance. It is thought that only a small fraction of the species are known. The purpose of this study is to add to and synthesize the present knowledge of the history, sytematics, morphology, distribution, habits, and phylogenetic relationships of the group. Classification is largely done at the supraspecific level, species usually being described only as types of the higher categories.

The family is divided into 3 subfamilies, one of which (Pygmephorinae) is further separated into 3 tribes. Twenty-nine genera and subgenera are described as new or redescribed as follows: *Dolichocybe, Pavania, Pyemotes, Caraboacarus, Paracarophenax, Acarophenax, Adactylidium, Trochometridium, Siteroptes* (*Metasiteroptes*), *S.* (*Siteroptes*), *S.* (*Siteroptoides*), *Resinacarus, Pediculaster* (*Pediculaster*), *P.* (*Acarothorectes*), *Pygmephorus, Microdispodides, Microdispus* (*Premicrodispus*), *M.* (*Microdispus*), *Myrmecodispus, Glyphidomastax, Perperipes, Peponocara, Parapygmephorus* (*Sicilipes*), *P.* (*Parapygmephorus*), *P.* (*Petalomium*), *Acinogaster, Pseudopygmephorus, Neopygmephorus* (*Neopygmephorus*), *N.* (*Allopygmephorus*).

Sixteen new species are described: *Paracarophenax dybasi, Adactylidium beeri, S.* (*Metasiteroptes*) *macer, S.* (*Siteroptoides*) *absidatus, Trochometridium tribulatum, P.* (*Acarothorectes*) *curculionium, Microdispodides pholidotus, M.* (*Premicrodispus*) *chandleri, Myrmecodispus dorylinis, Glyphidomastax rettenmeyeri, Perperipes ornithocephala, Peponocara cathistes, P.* (*Sicilipes*) *halictinis, P.* (*Parapygmephorus*) *natalensis, P.* (*Petalomium*) *krczali, Acinogaster marianae.*

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INTRODUCTION

The purpose of this paper is to add to and synthesize the knowledge of the systematics, morphology, habits, and phylogenetic relationships of this little-known group of mites.

This paper represents the second major revision of the family, being preceded by the excellent monograph of Krczal in 1959. It should perhaps be pointed out here that the two papers evolved nearly entirely independently and it is therefore a pleasure to note the many points of agreement between them. Every effort has been made herein to correctly credit those ideas originating with the former author. In a real sense, the two works complement one another, Krczal's stressing work at the species level, this paper being more concerned with higher categories.

The family is here divided into 22 genera, these further divided into 29 subgenera and approximately 120 species. This evaluation was made after the inspection of approximately 2400 slide-mounted specimens and on the basis of a careful survey of the literature.

In contrast to that of the Tarsonemidae, the classification of the members of this family is based primarily on the females, a circumstance resulting from the relative availability of the sexes. In at least the lower forms (*Pyemotes, Siteroptes, Acarophenax, Paracarophenax*) this is due not only to the sex ratio (five to ten percent males) but also to the transience of the males.

Because only a fragment of the total fauna is known and because of the relative scarcity of long series, satisfactory definition of both species and higher categories is sometimes quite difficult. In all cases categories have been defined using as many characters as possible, thereby placing a minimum of reliance upon so-called "weighted" characters. The limited use of such characters has been unavoidable, however, since the author has preferred to erect a phylogenetic as opposed to a "static" (in the sense employed by Sokal *in* Michener and Sokal, 1957) classification or one based upon "overall basic similarity" (Bigelow, 1958). Data are presently being gathered in order to compare such a classification with the one presented herein.

Both the size of the morphological gaps between species and the number of species included in a group were considered in erecting taxa. The establishment of monotypic genera was avoided except in cases (*e. g., Glyphidomastax*) in which the monotypic form showed an unusual amount of morphological isolation.

Certain genera, notably in the Neopygmephorini, are difficult to define because of the continuum of characters occurring between the various species. As pointed out by Michener (1944), however, such conditions are to be expected among continually evolving species groups and do not necessarily invalidate the classification.

Any specific characteristic, morphological or otherwise, which varied among species, was considered to be useful as a "taxonomic character."

Variation. A great amount of variation in size is present in both sexes, this reflecting itself in various body and setal dimensions. At least the latter may vary independently, *e. g.*, the dorsal setae of female *Trochometridium* are nearly equal in size although the largest specimen is a third bigger than the smallest.

Interpopulational variation in size does not differ markedly in extent from intrapopulational variation insofar as it is possible to judge. The author has often observed phoretic females of pyemotids or scutacarids from the same host specimen, therefore presumably from the same population, to differ greatly in this respect. In the case of the scutacarid *Imparipes americanus* Banks, such variation was seen to occur within the single earthen cells of certain bees and among individuals that may have been the progeny of one mother. In the same species, which is normally heavily pigmented, whitish or very pale individuals occasionally appear, a phenomenon known to occur in other mites, *e. g.*, Dermanyssidae.

Setal attributes other than size, such as number and location, remain remarkably stable within a species and are therefore used extensively as characters at specific and at higher levels. The variation of certain characters, such as amount of pigmentation, punctation, development of apodemes, etc., is often not useful because it is inseparable from extrinsic variation due to clearing and mounting.

Distribution. The effect of the distribution of pyemotids upon their classification has not yet been evaluated thoroughly. Early acarologists, *e. g.*, Berlese and Jacot, bound by the morphological species concept, ignored distribution altogether and considered forms from different continents to be conspecific if they were morphologically indistinguishable. Later specialists, aware of criteria of gene exchange in species separation, and certain that oceanic barriers must be limiting, often declared them to be distinct despite supposed inseparability on morphological grounds.

Excluding those species undoubtedly spread through commerce (*e. g.*, grain-inhabiting forms of *Pyemotes* and *Acarophenax tribolii*), it is evident that many, perhaps most pyemotid genera are widely distributed. *Acinogaster*, for example, occurs in Angola and Panamá, and *Neopygmephorus* and *Premicrodispus* are both found in Europe, North America, and Australia. Numerous other examples are available. Widespread distribution of species is seemingly less frequent. Comparison of various North American populations of *Pseudopygmephorus sellnicki* (Krczal) and the scutacarid *Scutacarus acarorum* (Goeze) with the descriptions and statements of variation among European specimens of these forms leads one to conclude that equal or sometimes greater morphological variation may occur in these species between nearby localities than between continents. A similar situation, based upon small sample sizes, seems to exist in certain species of *Premicrodispus* and *Neopygmephorus*.

Within North America, certain forms of *Pediculaster* and *Siteroptes* appear to vary interpopulationally in an irregular and recurring "mosiac" manner rather than in any clinal fashion but the data are too incomplete to permit definite conclusions to be drawn.

Although the vagility of mites is largely unknown, particularly over long distances, it seems certain that they are well represented in the air-borne fauna. Lindroth (1957) states that the microfauna is "above average" in respect to its presence in air samples although he cites no specific data. Gislén (1940) concludes that no geomorphological barriers exist for microscopic and semimicroscopic animals, their distribution being therefore dependent entirely upon ecological factors. Such species are therefore likely to be cosmopolitan within their ecological limits. It therefore seems not at all reasonable to recognize two species as distinct only because of their occurrence on different continents.

My admittedly incomplete data suggest that species in the Pyemotidae can easily be explained by such "continuous" distribution. Such a distribution is obviously of little value in determining the relative antiquity of the various groups.

Life Histories. The following briefly summarizes some aspects of the known life histories of mites in the family. Separate, more elaborate treatments may be found herein following the generic descriptions.

Gravid adult females may (Pyemotinae, Acarophenacinae, some Pygmephorini) become hugely distended and spherical or (most Microdispini, Neopygmephorini) such females may undergo only a slight size increase. Those of the first type usually contain considerable numbers (often over 100) of well developed ova. Females of the latter type rarely contain more than three well developed ova simultaneously.

In some Pyemotinae (*Pyemotes, Trochometridium*) and in the Acarophenacinae, the ova hatch into quiescent, indefinite forms which telescope all immature stages and terminate with the appearance of the adult mite. This development usually occurs within the distended maternal body so that the adult female gives birth to adults of the next generation. Rarely (*Trochometridium*) emergence of a new generation of adults occurs after death and partial decomposition of the mother's body. In *Siteroptes, Resinacarus,* and at least in most Pygmephorinae, a definitive larval stage is present. Except in the first-named genus, this stage is not known to be active and does not hatch from the egg but develops from larva to adult in the manner described for *Pyemotes* (above); however, at least some scutacarid females lay eggs which hatch into active larvae, these soon becoming quiescent and moulting directly to adults. The larvae of *Siteroptes* may hatch and actively move about, sometimes escaping from the body of the mother. Reuter (1900) states (probably erroneously) that a single nymphal stage is present in *Siteroptes.* Nymphal stages are otherwise unknown in the family. Omission of the various definitive immature stages greatly accelerates embryogenesis and, at least in the Acarophenacinae, development from egg to adult may consume only three days.

Birth of the young adults may occur continuously through the vulva (*Pyemotes*) or (probably) continuously through a secondary oviporus (*Perperipes*) or nearly simultaneously in conjunction with the hysterosomal breakdown of the mother (*Siteroptes, Acarophenax, Paracarophenax*).

Females are usually mated immediately after freeing themselves from the enveloping embryonic membranes and often within the body of the mother. In species practicing phoresy, they are the only known phoretic stage; they probably are responsible for the dispersal of the species in any event.

Unmated females of *Pyemotes* and *Siteroptes* rarely produce offspring; if so, such females are arrhenotokous.

The number of males is small, rarely exceeding five per cent of the total number of offspring in *Pyemotes, Siteroptes, Acarophenax,* and *Paracarophenax.* A higher percentage of males (probably up to 45 per cent) may occur in *Trochometridium.* Males usually complete their development before females and may then be born (*Pyemotes*) or may move about within the body of the mother searching for mates (*Acarophenax, Paracarophenax,* usually *Siteroptes*). In the latter case they may initiate or accelerate the hysterosomal breakdown resulting in the mass birth of the enclosed mites. Males of *Pyemotes* remain in the vicinity of the vulva after they are born and copulate with the females as they emerge. Such males may actually assist in the birth of the females by pulling them through the birth opening. They seemingly are parasites upon the body of the mother mite and die quickly if removed therefrom.

Food habits of known species are variable although generally constant at the generic level. *Siteroptes* and *Resinacarus* are probably fungivorous, *Pyemotes* is a parasite of various immature insects, *Trochometridium* is known thus far only as a parasite of larval Apoidea, and *Acarophenax* and *Paracarophenax* are egg parasites of beetles. To judge from morphological specializations and from collecting data, it is likely that *Glyphidomastax* and *Perperipes* are parasites of immature doryline ants and that most members of the Neopygmephorini are scavengers or fungus feeders.

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TECHNIQUES AND PROCEDURES

Collecting. Many species of pyemotids are found in moss, grass, litter, mammal and bird nests, humus, punky wood, and in other forms of vegetation, living or dead. Such specimens are collected into 70 per cent ethyl alcohol from a berlese funnel. The bodies of various insects are also good sources of material. Mites from these may be removed to alcohol with various moistened implements. Dead specimens from such sources are extremely fragile and should be relaxed before removing.

Freshly-killed vertebrates were first chilled then washed in the manner used by Lipovsky, Crossley, and Loomis (in litt.), a method which proved quite successful in the recovery of certain pygmephorines.

A fine camel's hair brush is useful in the handling of living material.

Mounting. Various methods of clearing and mounting were attempted. The two which proved most satisfactory were, (1) clearing in lactophenol and mounting in polyvinyl alcohol-lactophenol (PVA) as described by Lipovsky (1953), and (2) clearing in glacial acetic acid-chloral hydrate solution and mounting in Hoyer's medium. Providing the mount is not overly thick, the latter medium seemingly possesses the most desirable optical properties and, in addition, allows the preparation of excellent mounts if the specimen is gently heated after the application of the cover slip. It has the disadvantage of crystallizing in a short period of time, particularly in relatively dry climates.

Mites mounted in PVA are relatively more permanent but are less desirable for study than those in Hoyer's medium and do not seem to expand as well when heated.

Viewing. Observations and dissections were made of living specimens as well as specimens preserved in 70 per cent ethyl alcohol and in Carnoy's fixative. The latter proved excellent as a preservative for gross dissections, but dissected parts often proved difficult to clear for observation under high magnification. A similar difficulty was met while attempting to clear certain specimens preserved for long periods of time in ethyl alcohol.

A Leitz binocular microscope having a maximum power of 216 magnifications was used for the above dissections and gross observations. Slide mounts were observed using a phase microscope having a maximum magnification of about 1450 diameters. Most study was done at 970 × and 1450 ×.

Measurements. Measurements were taken with a .1-mm. grid micrometer placed within a 10 × ocular and were made under the highest magnification possible, 430 or 970 ×, depending upon the size of the structure involved. Estimations were made to the nearest tenth of a grid square. Independent measurements of the same specimens, repeated later, suggest that the extrinsic error involved is about ± .2 of a square (± 5μ at 430 ×, ± 2μ at 970 ×).

The mean was obtained for all measurements in cases where $n \geqslant 5$; its standard error was calculated only in those cases where $n > 10$.

The various measurements were as follows:

1. Length of body: Along sagittal line from anterior margin of propodosoma to posterior margin of hysterosoma.
2. Width of body: Widest point of hysterosoma measured along transverse axis of body.
3. Length of gnathosoma: Along sagittal line from palpal apex (palps in folded position) to posterolateral condylar processes.
4. Width of gnathosoma: Widest part of gnathosomal capsule measured along a transverse axis.
5. Distance between internal pseudostigmatal sockets: That between centers of origin of pseudostigmatal pedicels.
6. Lengths, legs I to III: Along longitudinal axis of leg from most basal point of trochanter to base of claw(s).
7. Length, leg IV: Along longitudinal axis of leg from most basal point of coxa to base of claws. Because of the curvature of these legs in the more specialized genera this measurement was often divided into two or more sections.
8. Lengths, leg segments: Greatest possible measurement along longitudinal axis of segment. Tarsal measurements exclude claw(s) and pulvillus.

9. Width, trochanter: Measured along transverse axis at apex of trochanter.

10. Width of coxa IV: Width along transverse axis at medial coxotrochanteral condyle.

11. Distances between setae are measured as the distances between the centers of the areoli.

12. Distances between apodemes I and II, and between apodemes II and the posterior marginal apodemes, are measured along the anterior median apodeme.

Other measurements (*e. g.*, that between the anterior sternocoxal condyles of coxae III) are self-explanatory, or are used only rarely and explained at the place of their appearance in the text.

In addition to the errors in measurement due to estimation (see above) certain other sources of extrinsic error should be mentioned. Perhaps the most obvious of these is the distortion of body shape that occurs in preparation of a slide mount. Such distortion is perhaps greatest in width, but is also considerable in length, the more so because of body segmentation in the species concerned. A second source of distortion is due to the position of the mite on the slide, this distortion often imparting an incorrect impression of the shape, size, or location of the structure concerned. Other sources of error may be due to differences in type and amount of clearing and in the kind of mounting medium. Differences in appearance caused by any of the above may overlap natural differences, thus making the detection of intrinsic variation difficult. Of course every effort has been made to take into consideration artificially produced differences and to recognize the naturally occurring differences.

Because they serve as a classificatory framework in a poorly-known group, generic descriptions are purposely overdetailed. This detail should be of assistance in pointing out characters of value to future workers.

The descriptions of new species are based upon the type specimens, variation encountered within the type series being indicated in parentheses.

Structures were drawn to scale but setal lengths and thicknesses were estimated and the reader is referred to the descriptions for detail. In a few cases where they could not be included without causing probable misinterpretation, one or more tarsal setae have been omitted from the illustrations of whole mites. Such omissions will not hinder identification of the forms concerned. All setae have been illustrated in the separate, enlarged drawings of tarsi.

For those forms in which the types were not available and which were inadequately described, the author has purposely tended toward conservation in the retention of species names, hoping thereby to keep nomenclatural confusion to a minimum. The reader is referred to the species lists following each generic description for generic assignments of species.

THE FAMILY PYEMOTIDAE: HISTORY

Although the family was not formally recognized by Berlese until 1898, certain species now placed in the genus *Pyemotes* were among some of the earliest known acarines. The distinctive, enormously gravid females were noted by Hartig (1834), von Heyden (1835), and DeFilippi (1861) on larval Hyemoptera and by Debey (1849) on larval Coleoptera. Many other authors reported them as parasites of various insect larvae, sometimes because they proved extremely destructive to cultures of species under investigation (Lichtenstein, 1868, 1869, 1875).

Closely related species were found, at about the same time, to cause the urticarioid dermatitis widely known among workers with stored grains in central Europe and America and commonly referred to in this country as the "grain itch." Perhaps the first association of this affliction with mites was made in 1838 in France by P. Debia, who incorrectly assumed it to be caused by a mite belonging to the family Acaridae. A large amount of literature has been and continues to be concerned with the medical importance of members of the genus *Pyemotes*.

As mentioned by Beer (1954), various authors have disagreed on relationships between tarsonemoids and other mite groups. With few exceptions these disagreements have been between those authors believing them to be most closely related to the sarcoptiforms and those believing them closer to trombidiform types. The following account briefly states the historical development of classification in each of the two groups.

Newport placed his *Heteropus* (1850) in the family Sarcoptides Latreille. In 1877 Kramer erected the family Tarsonemidae to include the single genus *Tarsonemus* Canestrini and Fanzago, 1876. This family was placed in his Acarina Tracheata. In 1880, R. Canestrini placed *Pygmephorus* Kramer, 1877, in his family Oribatidi, considering the Tarsonemidae to be a separate sarcoptiform subfamily. This system was followed by Michael (1880) and by Haller (1881 and 1882). Berlese (1885) was the first to recognize the close relationship between *Tarsonemus* and *Pygmephorus*, placing them, together with *Disparipes* (= *Scutacarus*) in the subfamily Tarsonemidi of his family Oribatidi. The following year he became aware of *Pediculoides* Targioni-Tozetti, 1878, and after giving a history of the genus (= *Heteropus* Newport, 1850, = *Sphaerogyna* Laboulbène and Megnin, 1885) added it to the Tarsonemidi. He regarded the subfamily as transitional between his Oribatidi and Sarcoptidi because of the pseudostigmata, the strong ventral apodemes, and (mistakenly) a ventral genital opening. In 1895, 1897, and 1898, the same author realized the distinctness of the group and placed it in a separate suborder, the Heterostigmata, this suborder to consist of species in which only the females possessed stigmata. Later in 1898 he separated the Pediculoididae (= Pyemotidae Oudemans, 1937) from the Tarsonemidae, the former to include *Pediculoides, Pygmephorus,* and *Podapolipus* Rovelli and Grassi, 1888. His 1925 classification is similar except that he has followed Paoli (1911) in removing the genera *Disparipes, Diversipes,* and *Imparipes* to the family Disparipedidae (= Scutacaridae Oudemans, 1917). The principal supporters of the earlier views of Berlese were Banks (1905a, 1915), and Ewing (1909, 1929, and 1939; *vide* Beer, 1954).

Laboulbène and Megnin (1885b) described *Sphaerogyna* as a new name for *Heteropus* Newport, at the same time giving the first resume of the history of the genus. They placed it in the family Trombidiés near the tribe Cheyletides because of the structure of the gnathosoma and palps, the styliform chelicerae, and the positions of the legs. Similar systems were followed by G. Canestrini in 1888 and 1891, and by Trouessart (1896). The latter, on the basis of chelicerae, palps, and (erroneously) the male genital opening, placed the group as the section Tarsonemeae of his subfamily Cheyletinae.

Brucker (1901) used characters of the chelicerae, integument, and internal anatomy (the latter largely from the midgut and tracheae) as well as habits to erect a classification roughly parallel to that of the two preceding authors. In 1909, Reuter used essentially the same characters to erect the subordinal classification in use by most authors today. Within this classification tarsonemines were placed in the single family Tarsonemidae of the superfamily Trombididoidea.

Vitzthum (1929) recognized the three tarsonemine families of Berlese (1925), placing them in his supercohort and cohort Tarsonemini of Reuter's Trombidiformes. Oudemans (1931) removed

Podapolipus and several related genera to form a fourth family, the Podapolipodidae, otherwise retaining the classification of Vitzthum. Since 1929 no important change in classification has been made, although important papers have been written on the group by Vitzthum (1943), Baker and Wharton (1952), Beer (1954), Cunliffe (1955), and Krczal (1959b).

A unique classification, based solely upon stigmatal position, was proposed by Oudemans (1906). In this scheme the family Tarsonemidae formed a single group, the Trachelostigmata, closely related to both the Antistigmata (including the Uropodidae and Holothyridae) and the Stomatostigmata (including the single family Labidostomidae). This classification has been largely ignored by succeeding authors.

Excellent accounts of the history of the generic name *Pyemotes* were given by Oudemans (1936, 1937a).

COMPARATIVE MORPHOLOGY

Because of the lack of prior studies within the families of the Tarsonemoidea, the following section is offered, not as a principal area of investigation, but as a guide for more serious students of morphology.

The studies described below are limited to members of the family Pyemotidae, but there is little difference between the more specialized neopygmephorine members of this family and members of the family Scutacaridae and the following observations therefore are pertinent to the consideration of either family.

FEMALE

Gnathosoma

The anteriormost division of the body is the gnathosoma, a capsular structure probably derived from both palpal and cheliceral sources. In most pyemotids, as in the other Tarsonemoidea, it is free, protruding from and articulating basally with the propodosoma. In the more specialized genera of the Acarophenacinae, however, it is contained completely within and protrudes only slightly or not at all from the anteroventral portion of the propodosoma (figs. 43-50). In order to simplify the presentation of the following observations, these specialized acarophenacines will be dealt with separately following the discussion of the more ordinary forms.

Forms with gnathosoma free. In these forms, the gnathosoma is typically prognathous except in *Peponocara* and *Caraboacarus* (figs.

41 and 78) in which genera the lateral and anterior margins of the gnathosomal capsule are expanded ventrally to displace the trophi. In *Caraboacarus*, this displacement is only slight but it is pronounced in *Peponocara, P. cathistes* appearing distinctly hypognathous.

In dorsoventral aspect, the gnathosomal capsule (figs. 1, 2) is a variably shaped (globose, quadrate, rectangular, or ovoid) structure, its basal margin well sclerotized and produced lateroventrally into a pair of condylar processes. Probably only dorsoventral movement of the gnathosoma upon the propodosoma is possible. A dorsal, longitudinal, median apodeme may join the posterior margin, extending anteriorly for varying distances. The dorsal and ventral surfaces of the capsule extend anteriorly between the palpi and enclose the mouth parts from above and beneath.

Dorsally, the gnathosomal capsule usually bears two pairs of setae, the *internal* and *external dorsals* (fig. 1), of which the internals are always the most anterior. In *Pyemotes* and in *Dolichocybe* these setae arise well forward, the internals well in front of or in line with the second palpals. In all other genera the internals are posterior to the second palpals. In *Caraboacarus* and in certain species of the Pygmephorinae the external dorsals appear on the ventral surface. In *Microdispus* (*Premicrodispus*) the internal dorsals may be absent, and in at least one species of *Pygmephorus* both pairs of dorsals are lacking.

Arising laterally or dorsolaterally behind the palpi there may be one or two pairs of *postpalpal setae.* These usually lack distinct areoli and may be hidden along the lateral gnathosomal margin. They are especially difficult to see in certain *Pseudopygmephorus* and may be lacking in some *Premicrodispus.* Ventrally, a single pair of *gnathosomal ventrals* (fig. 2) usually arises from the anterior half of the gnathosoma. *Trochometridium* and *Caraboacarus* have a second pair of gnathosomal ventrals, those of the latter genus being heavily sclerotized and spheroid in shape.

In most prognathous forms (exception, *Pavania*) the palpi arise from lateral excavations of the gnathosomal capsule, their lateral margins forming a continuous line with the lateral margins of the capsule. They enclose the trophi at the sides. Basally they articulate with the capsule, being capable of at least lateral-mesal movement in all genera except *Pyemotes* and *Caraboacarus,* in which they are inarticulate and at least partly fused to the wall of the gnathosoma (Krczal, 1959, states that the palpi of *Pyemotes* are distinct and "slightly movable" but I am unable to discern either free margins or articulations in the specimens available to me). In these genera the line of fusion is more or less distinct and both pairs of palpal setae are retained. In *Pavania,* the palps are free and arise from the ventral surface of the capsule.

In forms having free palpi, these appendages are usually at least slightly palmate and possess one or more apical teeth. The teeth usually arise from the medioventral surface of the palp and may be free and seemingly movable (*e. g., Pygmephorus*) or fused to the palpal apex. In *Dolichocybe* and in some *Neopygmephorus* (fig. 2) the palpal teeth may be replaced by a clawlike hook. They are reduced in *Dolichocybe* and *Trochometridium* and absent in *Pyemotes* and *Caraboacarus.* In *Dolichocybe,* the palpi are subcylindrical, while in *Glyphidomastax, Perperipes,* and some *Myrmecodispus* they are greatly elongate and sharp.

In all forms seen by this author the palpi are one-segmented although in some forms (fig. 2) suturelike lines may occur on one or more surfaces. Oudemans (1931) mentions, probably mistakenly, forms with two palpal segments. The palps of *Pygmephorus thienemanni* Willmann (not seen by this author) are said to possess four segments; this form is seemingly highly specialized in other respects.

Universally present in all forms having a free gnathosoma, and arising from the dorsolateral, lateral, or ventrolateral margins of the palpi, are the conspicuous *first* and *second palpal setae,* the former the most basal. These often appear to divide the palps into three subequal areas, and, because of their constancy in location, may provide information concerning areas of differential growth. In addition, the inner apical surface of the palp may possess one or two tiny setae, these not always visible. Arising from the ventral surface of the apical half in many forms are *palpal solenidia 1* and *2.* The latter is atypical in appearance, being non-striate. It may be cylindrical, clavate, capitate, cuspidate, or concave apically, and is nearly always much larger than solenidium 1. The latter is typically striate and arises lateral or posterolateral to 2. In *Pavania, Pyemotes,* and *Trochometridium,* at least solenidium 2 is reduced and may be indistinct. In *Caraboacarus, Perperipes, Glyphidomastax,* and some *Myrmecodispus,* the palpal solenidia may be lacking. Palpal setation frequently offers specific characters, particularly as regards shape and placement of the various setae.

The palps probably function in most forms to anchor the mite to the substrate while it feeds.

The trophi were not studied intensively for purposes of this work and the following brief account is taken largely from the excellent work of Krczal (1959b) and refers to *Pyemotes.*

The chelicerae are dorsal, their distal portions styletlike, their bases guttate, recurved laterally, housed in anterodorsal pockets which may appear broadly tuberculate upon the dorsal surface of the capsule. Their guttate bases are prominent landmarks of the gnathosoma, often visible when the sylets are indistinct. At least in *P. scolyti,* the chelicerae are separated by a longitudinal dorsoventral septum and bounded dorsally and ventrally by chitinized plates. The styli are independently protracted or retracted by muscles originating basally (protractors) or laterally (retractors) from the capsular wall and inserting basally (protractors) and distally (retractors) upon the cheliceral base (*"Stechborstenhebel"* of Krczal). Beneath the cheliceral opening lies the oral orifice, enclosed apically in an acuminate cone. This cone is inserted into the wound made by the chelicerae once the latter are withdrawn, and the sucking operation commences. The oral cone is contiguous with an enlarged, ovoid, ventral esophageal-pharyngeal pump ("pharynx" of authors). Brucker (1901), in describing the operation of this pump, states that it expands slowly, then contracts quickly to push the liquid food into the gut. Contractions were noted to be on the order of about 50 per minute. With certain modifications, the foregoing is probably similar to the structure and function of the mouthparts of most Pyemotidae. The chelicerae are enlarged and falcate in *Pavania,* often bladelike in *Pyemotes, Trochometridium, Pepoponocara,* and in all genera of the Acarophenacinae, but are smaller and usually indistinct in all remaining genera. It should perhaps be mentioned that with the exception of *Pyemotes,* all those forms with enlarged chelicerae are phoretic upon the adults of (and probably parasites of the immature stages of) various insects. The seemingly rare occurrence of phoresy in species of *Pyemotes* correlates well with the broad host tolerance seemingly characteristic of that genus.

The ovoid esophageal-pharyngeal pump is reduced in *Dolichocybe* and absent in all other genera possessing a free gnathosoma. In these latter the flexible esophagus is usually visible posterior to the chitinized buccal chamber. Within the gnathosoma, it may be straight or characteristically looped, coiled, or spiralled. In the Pygmephorinae, a pair of small, globular or elongate structures are often found adjacent to the esophagus. They appear to connect to it and perhaps are salivary glands. In the Pygmephorini and Neopygmephorini a narrow "finned structure" in the shape of a bow-tie may be visible. If present this structure is always followed by one or two similar structures located in the propodosoma. These will be mentioned in more detail later. The supra- (*"Chitinspange"*) and sub-cheliceral plates (*"Chitinplatte"*) of Krczal assume varying shapes or are absent in genera other than *Pyemotes.*

Gnathosoma hidden. In *Acarophenax, Paracarophenax,* and *Adactylidium* (figs. 43-50) the gnathosoma is much reduced and nearly or completely enclosed within the propodosoma, with which structure it may be partially fused. Its structure is therefore difficult to ascertain. The palps of such species are not or only partly distinct and setae of the gnathosomal region are lacking except in *Acarophenax,* which possesses one to three pairs. The most prominent gnathosomal structures in these forms are the enlarged, anteroventrally or ventrally directed chelicerae and the esophageal pharyngeal pump, both of which are similar to those described above for *Pyemotes.*

In addition to the above, species of *Paracarophenax* exhibit a unique, elliptical, median ventral structure which may be the paired salivary glands and their heavily sclerotized ducts (the lateral "sclerotized margins" of this structure are indeed tubular). Paired ducts presumed to be salivary are distinct beneath the respiratory system in *Acarophenax* and *Adactylidium.* In the region of the dorsal U-shaped apodeme these fuse, the resulting duct appearing to be suspended from a thin median longitudinal apodeme which may be contiguous posteriorly with the U-shaped apodeme. Anteriorly, this duct bends ventrad to enter the anterior portion of the pharyngeal pump at which juncture it may become campanuliform or otherwise dilated.

Propodosoma

The propodosoma (figs. 3 and 4) is the second body division. Located between the gnathosoma and the hysterosoma, it is the section of the body bearing the first two pairs of legs. Except for the genera *Acarophenax, Paracarophenax,* and *Adactylidium,* which will be discussed later, the propodosoma consists of a single structure which, in shape, may be likened to a sleeveless sweater with four instead of two armholes. In the Pyemotinae, its dorsum is about as long as the venter, while in the majority of the Pygmephorinae the venter is distinctly longer than the dorsum. The anterior *circumgnathosomal foramen* varies greatly in shape and position, its characteristics greatly dependent upon the manner in which the gnathosoma is normally carried. In those genera (*Pyemotes, Dolichocybe, Caraboacarus*) in which it is directed straight forward, or nearly so, the foramen opens approximately at a right angle to the longitudinal axis of the body. In some *Siteroptes, Resinacarus,* and in most of the Pygemophorinae, the gnathosoma is carried at least slightly downward and is often bent directly ventrad or posteroventrad. In these forms the propodosomal dorsum is elongated to cover the gnathosomal base, thus displacing the foramen ventrad. The ventral margin of the foramen may be entire or deeply emarginate to allow for the reception of the gnathosoma in those species in which it is normally carried posteroventrally. In *Pygmephorus* and in some *Parapygmephorus* the lateral margins of the circumgnathosomal foramen may be heavily sclerotized, appearing to form a "collar" for the gnathosoma. In such cases the later is carried nearly vertically with only its dorsum and apex exposed. Whether entire or emarginate, the ventral margins of the circumgnathosomal foramen are always greatly thickened to form *apodemes I* (Epimerites I of Krczal) which function to provide strengthening for the anteroventral sternocoxal condyles of coxae I as well as to provide reinforcement for the foraminal margin and points of gnathosomal articulation.

The entire ventral surface of the propodosoma (fig. 3) is the *anterior ventral plate.* It is bounded anteriorly by apodemes I and its posterior limits may (Pygmephorinae) or may not (most Pyemotinae) be well defined by the *posterior marginal apodemes* (Epimera II of Krczal) which are usually most distinct laterally. At the sides, the posterior marginal apodemes bend first dorsally, then anteriorly to provide dorsal support for legs I. In some species of *Myrmecodispus* and *Acinogaster,* these dorsal arms may become enlarged and scapuloid.

Directed longitudinally and joining apodemes I with the posterior marginal apodemes is the *anterior median apodeme* (Sternum I of Krczal). This apodeme may be weak, interrupted, or intermittent (various species), but it is invariably present.

Apodemes II (Epimera I of Krczal) arise laterally near the anterior sternocoxal condyles of legs II and terminate mesally in or near the anterior median apodeme. In the Pyemotinae, Acarophenacinae, and Pygmephorini they are usually straight or sigmoid and join anterior sternocoxal condyles II laterally. A lateral fold or apodeme, which is continuous with apodeme II, is usually present between the anterior sternocoxal condyle of coxa II and the posterior portion of coxa I. In the Microdispini and Neopygmephorini apodemes II are usually distinctly arcuate. In these tribes, they often terminate mesal to sternocoxal condyles II and integumental folds or thickenings continuous with them often reach the areoli of external ventrals I. Apodemes II are weak or absent in *Dolichocybe,* some Microdispini, and some *Parapygmephorus.*

In a few Microdispini, most Neopygmephorini, and most Scutacaridae, a *secondary transverse apodeme* may be present. This apodeme is straight or slightly procurved. It passes near or through the intersection of apodemes II with the anterior median apodeme at about a right angle to the latter. The intersection of these two sutures at the anterior median apodeme delimits between them, on each side, a lateral trianguloid sclerite which bears ventral setae II. In forms possessing this sclerite, external and internal ventrals II are always close together. This arrangement differs from that found in more primitive forms in which the setae tend to be more evenly spaced across the ventrite.

The nomenclature of basal acarine leg segments has long been a subject of disagreement among various workers. Vitzthum (1943) believed the femur and genu (or, in females of Tarsonemidae, genu and tibia) to be fused, the definitive leg segments then being coxa, trochanter, femur (or femurogenu), tibia (or genuotibia), and tarsus. Oudemans thought that the coxae had fused with the sternum, the first definitive segment therefore being the trochanter. Beer (1954) deemed the evidence insufficient to support the view of Oudemans and designated the first definitive segment as the coxa. Krczal (1959) follows Oudemans in believing that the coxae have become flattened and platelike, fusing with the primitive sternum to become the definitive ventral plate. This belief is based largely if not entirely on the fact that the ventral apodemes are of such disposition that they may be construed as being lines of fusion between coxal plates. Other points considered in favor of this thesis are (1) musculature and (2) that in certain prostigmate groups the coxa is generally regarded as being fused with the sternum (*e. g.,* Trombiculidae, *vide* Wharton and Fuller, 1952, Hydrachnellae, *vide* Mitchell, 1955, and others).

The present author does not deny the possibility of correctness of the foregoing hypothesis but wishes to point out the following: (1) The ventral apodemes undoubtedly do not represent the true lines of fusion between the coxae, as a comparative study of the various genera will show, but vary greatly in shape and extent, at least in part according to the requirements for reinforcement and areas for muscle attachment in a particular form, this in turn dependent upon the amount and type of locomotion, carriage of the legs, size and shape of the mite (compare apodemes IV of *Periperipes* and various scutacarids), and other factors. For example, apodemes IV in *Siteroptes*, the species of which have functional hind legs, terminate laterally at anterior sternocoxal condyle IV, a point at which strengthening is needed. In the Neopygmephorini and Microdispini, groups in which legs IV are modified and therefore used sparingly if at all in normal locomotion, the same apodeme terminates in coxal foramen III, usually in its anterior half. Moreover, ventral apodemes are the most poorly developed in what seem to be the most primitive genera (*Dolichocybe, Pyemotes, Trochometridium, Siteroptes*) and in the known larvae, although larvae of all genera studied retain such primitive characters as two claws on tarsus I and five-segmented front legs. (2) Although the coxae of certain prostigmate mites appear to be fused with the venter, no evidence of the relationships of these forms to the Tarsonemoidea has been presented. Indeed, specific examples of such forms are not cited by Krczal in his work. (3) It seems to this author premature at this time to make claims based upon myology since no detailed studies have been made for any group in the Tarsonemoidea. Although it is true that most muscles responsible for leg movement do arise from the ventral apodemes, this does not indisputably establish coxal origins of the latter. Specimens of *Trochometridium tribulatum* cleared in xylene and mounted in balsam by this author resembled certain unionicolids investigated by Mitchell (1955), in that the origins of the muscles inserted upon the first definitive leg segment were diverse. Thus, muscles appearing to be promotors and levators of legs I and II of *Trochometridium* originated side by side from the posterior marginal apodeme and muscles appearing to function as remotors and levators of the same legs originated side by side from the anterior median apodeme well cephalad of apodemes II.

In consideration of the above, it is felt that the assumption of a coxal origin of the ventral plates is based upon meager evidence and should not be accepted uncritically. In any event, the terms (sternum, epimeron, epimerite) proposed for ventral plates and sutures by earlier authors are morphologically incorrect and there seems to be little reason for retaining them other than historical precedent. This author therefore prefers to use, with modification, the nomenclature used by Beer (Table I).

The four sclerites of the anterior ventral plate called coxae by Oudemans and his followers are accordingly designated as *ventrites,* those anterior to apodemes II as *ventrites I,* those posterior as *ventrites II.*

The anterior ventral plate bears from two to six pairs of setae (fig. 3). If two, four, or six pairs are present, they are equally divided between ventrites I and II. If three or five pairs are present, either ventrite may possess the odd pair. All members of the Acarophenacinae bear fewer than four pairs. Members of the genus *Pyemotes* and all members of the tribes Microdispini and Neopygmephorini bear four pairs, and the remaining genera bear five or six pairs. These setae are named in the manner designated by Krczal (1959b), except that the author prefers to substitute, for reasons explained above, the word "ventral" for "coxal" (Table I). Which of the ventral setae drop out or are added in the various genera is not known and the author arbitrarily designates the pair normally present in some Pyemotinae and Pygmephorini but lacking in the Microdispini and Neopygmephorini as the median ventral pair. External ventrals I are furcate in some species of *Siteroptes, Pseudopygmephorus, Neopygmephorus,* and *Parapygmephorus,* simple in the remaining forms.

The propodosomal dorsum is irregularly trapezoidal, elongate, or inversely T-shaped. Its posterior margin may meet or overlap the first hysterosomal tergum (Acarophenacinae, most Pyemotinae) or be overlapped by the latter (Pygmephorinae). In most members of the last-named subfamily it is delimited posteriorly by a *dorsal transverse apodeme* the ends of which fuse with the dorsal margins of coxal foramina II.

The two variously-shaped *peritremes* (fig. 4) enclose and are usually distinct from the *stigmatal openings.* Both are lacking or at least not discernible in *Pavania* and *Dolichocybe,* but present in all other genera. The shape, proximity, and position of the peritremes are useful in classification at both the generic and specific levels.

Posterior to the peritremes arise the *pseudostigmata.* These two capitate, bladderlike organs are of uncertain function but are almost certainly sensory receptors. Each originates deep within the propodosoma from the *internal pseudostigmatal socket* and usually (exceptions, *Pavania* and *Dolichocybe*) passes through the center of a series of concentric ringed structures, the *external pseudostigmatal socket,* in the region of the body wall. The structure of the rings of the external socket indicates that it is probably capable of response to the slightest movement of the pseudostigmata.

From one to three pairs of dorsal propodosomal setae are present (fig. 4), these often greatly reduced in forms in which the propodosoma is covered by the first hysterosomal tergum. The most anterior pair of these setae ("verticals" of Krczal) are nearly always closely associated with the peritremes and are called the *stigmatals* herein. The most posterior pair ("external scapulars" of Krczal), usually arising mesad or posteromesad of the pseudostigmata and always distinctly longer than the others, is called the *posterior pseudostigmatals.* The remaining pair usually arises anterior or anteromesal to the pseudostigmata and is designated the *anterior pseudostigmatal* pair ("internal scapulars" of Krczal). A predictable sequence of loss usually occurs among these setae, the stigmatals nearly always being lost first, followed by the anterior pseudostigmatals. The number of pairs of dorsal propodosomals is of value in the higher classification of the family while their size and placement is useful in species determination.

In the genera *Acarophenax, Paracarophenax,* and *Adactylidium* a unique division of the propodosomal dorsum occurs. In these genera, the superficial dorsal surface is enlarged to form the *dorsal propodosomal plate* (figs. 46 and 49), its anterior margin covering the gnathosomal region, its posterior margin covering the first hysterosomal tergum. Because of its size and structure, this dorsal plate greatly resembles the enlarged first hysterosomal tergum ("clypeus" of authors) found in the Scutacaridae and in some specialized pyemotids and may easily be confused with it. This parallelism may have led Vitzthum (1943), Hughes (1948), and others to incorrectly assign *Acarophenax* to the Scutacaridae. A smaller, more internal portion of the propodosoma, the *propodosomal arcula,* which is boxlike or nearly so, apparently functions to enclose and, at least in *Acarophenax* and *Adactylidium,* seems to fuse with the reduced gnathosoma, providing areas for muscle attachments and points of articulation. In addition, it bears the peritremes. At least in *Acarophenax* and *Adactylidium* this arcula may be partly or largely sclerotized. In these genera it is visible from above as a heavy U-shaped or tridentoid apodeme, the lateral arms of which bear the anteriorly-directed peritremes at their apices (fig. 5). Other dorsal apodemes may arise from the vicinity of the stigmatal openings, proceeding mesally apparently to fuse with the walls of the buccal cavity. The ventral or anteroventral portion of the arcula, which encloses the more or less reduced mouthparts, may be an anterior extension of the anterior ventral plate, in which case the most posterior setae of the gnathosomal region may be the first internal ventrals. In all three of the above genera the arcula appears to enclose the anterior portion of the gnathosomal region, but this point is not clear.

The bipartition of the propodosoma apparently allows the dorsal plate to separate from the remaining gnathosomal-propodosomal complex, thus allowing more space for the developing young. Rack (1959) illustrates this condition (pp. 416-417) in *Paracarophenax dermestidarum* but does not mention it in the text.

Pseudostigmata are lacking in *Paracarophenax, Acarophenax,* and *Adactylidium.* The dorsal plate bears two or three pairs of setae, while the arcula bears zero to one pair of dorsal or anterior setae and one to two pairs of ventrals. Homologies of the propodosomal setae in these genera are not clear.

Internal anatomy. Structures associated with two major systems, the respiratory and digestive, are usually visible in the region of the propodosoma and may be useful as taxonomic characters.

The peritremes enclose the stigmatal openings, which are usually circular (most Neopygmephorini) but may be slitlike (*Trochometridium*). In some genera (*e. g., Microdispus*) the stigmata open anteriorly, their openings being therefore hidden, but in most cases they turn dorsally into the peritremes and their tubular nature is readily observable. These openings are the terminations of the main tracheal trunks which proceed posteromesally into the propodosoma, each connecting there with a bulbose internal atrium designated by Krczal (1959b) as division III of the tracheal trunk. This division is strongly sclerotized in some Acarophenacinae, a fact which led Hughes (1948) and others to characterize *Acarophenax* as possessing two pairs of stigmatal openings. The posterior end of this division appears sievelike, its external surface giving rise to

TABLE I.—Terminologies of Beer (1954), Krczal (1959) and Cross for Structures of the Propodosoma

Beer, 1954	Krczal, 1959	Cross
....	....	circumgnathosomal foramen
apodeme I	epimerite I	apodeme I
transverse apodeme	epimeron II	posterior marginal apodeme
anterior median apodeme	sternum I	anterior median apodeme
....	anterior sternal plate	anterior ventral plate
apodeme I	epimeron I	apodeme II
....	....	secondary transverse apodeme
....	coxae I–II	ventrites I–II
....	setae coxales externae mediae internae } I & II	external median internal } ventrals I & II
....	....	dorsal transverse apodeme
stigmatal openings	stigmata	peritremes
stigmatal openings	stigmata	stigmatal openings
....	....	internal pseudostigmatal socket
....	....	external pseudostigmatal socket
....	setae verticales	stigmatal setae
....	setae scapulares internae	anterior pseudostigmatal setae
....	setae scapulares externae	posterior pseudostigmatal setae
....	....	dorsal propodosomal plate (some Acarophenacinae)
....	....	propodosomal arcula (some Acarophenacinae)

a number of fine tracheae. These tracheae may be long or short, probably depending (at least to some extent) upon the species. In *Pyemotes* they may reach the posterior extremity of the opisthosoma (Krczal, 1959b), in S. (*Siteroptoides*) they are visible as far as the posterior margin of coxa IV, and in most Acarophenacinae they appear still shorter.

Air was seen to issue only from the structures designated herein as peritremes when specimens of *Pygmephorus* and *Neopygmephorus* were drowned in alcohol and probably these comprise the only external respiratory openings.

The esophagus is often visible within the propodosoma. In some *Siteroptes,* and most Pygmephorinae, one to three separate circumesophageal "finned structures" are distinct within the propodosoma and the anterior portion of the hysterosoma. The anatomy and function of these structures is uncertain at present but Krczal's conjecture that they are esophageal pumps seems reasonable. The shape and number of these structures and the structure of the fins are sometimes used as diagnostic characters (see generic descriptions).

Hysterosoma

The largest and most posterior of the three body regions is the hysterosoma. In dorsal aspect, this region usually consists of four distinct, telescoping body segments, the most posterior usually completely overlapping a fifth[3] segment which may be cuplike or reduced to a ventral plate, or vestigial. Ventrally, the large *posterior ventral plate* bears the third and fourth pairs of legs. Its posterior margin overlaps the platelike *opisthosomal venter* which, in turn, usually overlaps the ventral portion of the fifth segment.

The hysterosoma is movable against the propodosoma, a distinct conjunctiva separating the two. This conjunctiva may arise from the adjacent margins of the two regions or, in those genera in which the first hysterosomal tergum overlaps the propodosoma, the dorsal conjunctiva of the former sclerite may arise from an arcuate transverse apodeme behind its anterior margin. In genera in which physogastry involving the entire hysterosoma is pronounced, the conjunctiva between propodosoma and hysterosoma may be visible as distinct pleated bands which unfold as physogastry progresses.

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[3] Although Krczal states that the hysterosoma consists of only three dorsal segments and a "*Chitinkappe,*" the present author finds (at least in *Perperipes, Neopygmephorus,* and *Pygmephorus*) four distinct dorsal segments plus the sclerite designated herein as segment V. The latter may or may not be caplike. He is of the opinion that five segments probably also exist in most remaining genera, although in the more specialized forms of the Acarophenacinae the fifth segment may be absent or reduced to a ventral plate which no longer bears setae. Oudemans (1931) mentions species of pyemotids with seven dorsal segments but these observations are probably incorrect.

Dorsum. Sclerites. The first tergum may meet, be overlapped by, (Pyemotinae, Acarophenacinae) or overlap (Pygmephorinae) the posterior margin of the propodosoma. The degree to which the last-named condition occurs varies considerably within the Pygmephorinae. In some forms, only the posterior margin is covered, while in others the entire propodosomal dorsum is hidden. This latter condition has arisen several times within the Pygmephorinae (Microdispini, some *Petalomium, Allopygmephorus*) as well as being characteristic of the entire family Scutacaridae. In the latter family the first tergum ("clypeus" of Berlese and others) is especially large, being expanded both laterally and anteriorly to completely cover the propodosoma as well as the basal portions of the gnathosoma and legs I and II. In the Scutacaridae the "clypeal" margins are always free and radially striate (the striae seemingly conjunctival in origin), a condition only recently discovered in two new genera (*Perperipes* and *Glyphidomastax*) of Pyemotidae. In all other pyemotid genera, if the first tergum is enlarged, its anterior and lateral margins are neither free nor striate.

Tergum I of *Trochometridium* differs from that of all other genera in that it is not entire, but tripartite, consisting of a single quadrate mesal plate and a pair of lateral plates which overlap the former mesally.

Terga II to *IV* are bandlike and, except for their posterior margins, which may be procurved in some species (*e. g., Pseudopygmephorus sellnicki*), and for their setation (which will be discussed later), offer no unusual modification. In a few forms, a pair of rounded, pale areas are visible on segments II or III. These mark the dorsal insertions of the dorsoventral muscles. In some species, a wide band of conjunctival pleats is visible between terga III and IV.

Segment V is usually completely overlapped dorsally and laterally by segment IV. In lateral mounts and in dissected specimens it is often seen to be a cuplike cap which encloses the posterior end of the mite. It bears the slitlike apical or apicoventral vulva. In *Dolichocybe* and *Pavania* the fourth segment forms the terminal cap. In these two genera its anterior margin is contiguous ventrally with segment V, the latter plate-like and bearing a single pair of short setae which flank the vulva. The anterior margin of segment V is contiguous in turn with a separate, flattened sclerite, the *antevulvar plate* (fig. 17), unique to these two genera. The latter bears an internal genital sclerite and, externally, two pairs of tiny setae. Its origin is unknown. In *Pyemotes* and in the more specialized Acarophenacinae, a reduction of the fifth segment is also found, this accompanied by a reduction or loss of the setae therefrom.

Setation of dorsum. The setation of the hysterosomal dorsum is generally consistent and perhaps homologous throughout the Tarsonemoidea and is quite similar to that found in many families of the Prostigmata. Without exception, the first hysterosomal tergum bears two pairs of setae, the second a single pair (fig. 4). The third tergum bears two pairs of setae in all forms except several species of *Siteroptes,* in which only a single pair may be present. Tergum four bears two pairs of setae except in *Metasiteroptes macer.* Setation of the fifth segment is variable. One pair is present in *Dolichocybe, Pavania,* and *Pyemotes,* all remaining pyemotine genera possessing three pairs. Acarophenacine genera resemble *Pyemotes* in having one pair except for *Adactylidium* and some *Acarophenax,* in which segment V is without setae. Three pairs of setae are present in all Pygmephorini, in a few Microdispini, and in most (exception, *Allopygmephorus*) Neopygmephorini. In most Microdispini and in *Allopygmephorus* only two pairs are present. The number, shape, and position of the dorsal setae are used to separate both species and genera. The author believes the setae of the first four terga to be homologous, and in order to show this homology, as well as for purposes of simplification, further modifies Krczal's modification of Paoli's (1911) terminology (Table 11).

Venter. Sclerites. Ventrally (except in *Pavania* and *Dolichocybe*) the hysterosoma consists of but two easily recognizable plates, the *posterior ventral plate* and the large *opisthosomal venter* (fig. 3). The former bears the two posterior pairs of legs. If it is primitively composed of the sterna of two segments (and in addition, perhaps, the fused coxae), then no line of fusion between these segments exists in the genera presently known. In two forms, *Siteroptes* (*Metasiteroptes*) and *Pediculaster* (*Acarothorectes*), a transverse division of the posterior ventral plate occurs, but this is undoubtedly a secondary development. In the genera *Pyemotes* (fig. 21) and *Trochometridium* (fig. 30) this plate is tripartite, consisting of two lateral portions and a mesal portion. The former meet and overlap only in the anterior portion of the plate. Dorsal to these two lateral plates and between their mesal margins is the triangular mesal portion of the plate, easily recognizable by its shape and position and because it bears a single pair of poststernal setae. In all remaining genera the posterior ventral plate is entire.

The anterior margin of the posterior ventral plate is entire and recurved. Laterally, each margin consists of a single flap which extends dorsally to cover the lateral margin of the second hysterosomal tergum, but lies beneath that of the first tergum. At least in *Acarophenax tribolii* each lateral flap is split (fig. 43) along a line terminating ventrally near the anterior margin of coxa II. The posterior portion of this flap covers the lateral portion of the second tergum as described above, while the anterior portion is enclosed by the first tergum. In all other genera the lateral flaps are seemingly entire.

In those forms in which the posterior ventral plate is entire, its posterior margin may be variously excavated, linear, or lobate. In *Dolichocybe, Paracarophenax,* some *Pseudopygmephorus,* and in most of the Microdispini, this margin is tripartite.

The posterior ventral plate has four apodemes whose development and shape are useful in classification. The *posterior median apodeme* may be present in varying degrees or absent. It corresponds to and often appears to be a continuation of the anterior median apodeme. *Apodemes III* and *IV* are diagonal or transverse and may be complete or incomplete in the various genera. In presumably primitive Pyemotinae (*e. g., Dolichocybe, Pavania, Pyemotes*), and in some Acarophenacinae, these apodemes are well developed only laterally and serve to strengthen the anterior sternocoxal condyles of their respective legs (figs. 13, 21, 43, 45, 48). The posterior median apodeme is usually completely absent in these forms. Assuming the above arrangement to correspond to the primitive condition, figure 7 illustrates a proposed sequence of stages in the evolution of these apodemes. In general, there is a tendency toward the increased development of apodemes III and IV as well as the posterior median apodeme in the higher Pyemotinae and lower Pygmephorinae [some *Siteroptes s. s., S.* (*Siteroptoides*), *Pediculaster*], followed by a decrease in size and distinctness in the higher Pygmephorinae. There is, however, a continuous trend toward the anterior migration of apodemes III and IV in all genera, culminating in the arrangement depicted in *Neopygmephorus* (fig. 7h). In this genus, apodemes III are entirely or almost entirely lost and apodemes IV have lost their original contact with the anterior sternocoxal condyles of legs IV, their lateral terminations joining the anterior halves of the inner margins of coxae III instead. *Apodemes V* are present only in *Trochometridium* and some species of the genera *Siteroptes, Pediculaster,* and *Pygmephorus.* They extend obliquely from coxal foramina IV to the posterior termination of the posterior median apodeme. Probably the loss of the strengthening apodemes of legs IV and their migration anteriorly is correlated with changes with the modification of legs III and IV (p. 64).

In all genera but *Dolichocybe* and *Pavania,* the opisthosomal venter is a single, large plate whose anterior margin arises beneath the posterior margin of the posterior ventral plate and whose posterior margin overlaps the ventral portion of the fifth segment. The shape of the margin of the latter varies intraspecifically in at least some forms. The lateral margins of the opisthosomal venter resemble those of the posterior ventral plate in being flaplike. They probably cover the lateral margins of the third tergum and lie beneath the second tergum in the manner shown by Krczal (1959b, p. 388) although this cannot be verified in all genera. A band of pleated conjunctiva may connect the posterior ventral plate with the opisthosomal venter. In *Pyemotes* and in some Acarophenacinae a second band may be present between the opisthosomal venter and segment V. In *Dolichocybe* and *Pavania* (figs. 13, 17), the opisthosomal venter is divided into a pair of earlike lateral lobes. These lobes do not meet medially and are separated posteriorly from the antevulvar plate by a distinct, pleated conjunctival band. Their lateral margins were not seen by this author.

Setation of the venter. The setal nomenclature of the posterior ventral plate proposed by Paoli and retained by Krczal (1959b) is utilized here without change (Table II and fig. 3). Six pairs of setae occur on this plate in all forms except the following, in which this number is reduced: all of the Acarophenacinae except *Caraboacarus, Pyemotes,* certain species of *Siteroptes,* and certain species of *Pediculaster.* In the first group mentioned, one to three pairs may be lacking, while the remaining genera lack one or (rarely) two pairs.

The *internal presternals* are always present, arising near or in front of apodemes III (or their remnants) usually near the posterior median apodeme. The *first axillaries* arise near to well anterior of apodemes III and near the margin of the third coxa. They are invariably present. The *external presternals* always arise at least slightly behind the internal presternals and distinctly mesal to the first axillaries. In most Pygmephorinae these setae arise near or anterior to apodemes IV. They are rarely absent (some Acarophenacinae). The *second axillaries* arise anteromesal to but near

TABLE II.—Comparative Terminology of Beer (1954), Krczal (1959), and Cross for External Structures of the Hysterosoma

Beer, 1954	Krczal, 1959	Cross
....	tergites I–III	terga I–III
....	chitinkappe	tergum IV
....	chitinkappe	segment V
....	ventral shield I	posterior ventral plate
....	ventral shield II	opisthosomal venter
apodeme III	epimerite III	apodeme III
apodeme IV	epimeron III	apodeme IV
....	epimeron IV	apodeme V
posterior median apodeme	sternum II	posterior median apodeme
....	axillares I	axillaries I
....	axillares II	axillaries II
....	setae praesternales externae and internae	internal and external presternals
....	setae poststernales externae and internae	internal and external poststernals
....	....	opisthosomal ventrals
....	humerales internae	dorsals I
....	humerales externae	laterals I
....	dorsales	dorsals II
....	lumbales internae	dorsals III
....	lumbales externae	laterals III
....	sacrales internae	dorsals IV
....	sacrales externae	laterals IV
....	caudales internae	internal caudals
....	caudales externae I	external caudals I
....	caudales externae II	external caudals II

coxa IV (or from near the lateral terminations of apodemes IV in some Pyemotinae). They may migrate anteriorly as far as the center of the third coxal foramen (some Microdispini). They are invariably present. The *internal poststernals* arise in line with or behind the second axillaries and close to the posterior median apodeme. They may be absent in some Pyemotinae and Pygmephorinae. The *external poststernals* arise near or (usually) posterior to a line drawn between the anteromesal margins of coxal foramina IV, and are distinctly lateral to the internal poststernals in all known species. They may be absent in some species.

Internal morphology. The sclerotized portions of two systems, the digestive and reproductive, may be recognized in the hysterosomal region of cleared specimens of pyemotid mites. In unfed mites the former may be seen only rarely posterior to the dilated esophageal pumps. In such cases, it appears as a straight tube, similar to the esophagus in diameter, which seemingly ends blindly in the region of the third tergum. Several authors have thought the anus to be present but it has been established, at least in *Pyemotes* (*vide* Brucker, 1901, and Pätau, 1936) and *Siteroptes* (*vide* Reuter, 1909a), that the gut ends blindly. Reuter states that the anus is lost completely in *Siteroptes* except for a transitory "*Exkretionsporus*" found in the early embryo.

The structure of the reproductive system is much more complex. Brucker (1901) and Reuter (1909a) have investigated this system in *Pyemotes* and *Siteroptes* respectively and report similar findings which may be summarized as follows: The female genital organs are simple and consist of the *vulva*, which serves both as the true vulva and the ovipore or birth opening. This opens into the tubular *vagina* (oviduct of Reuter), from which a pouchlike dilation (the *receptaculum seminis*) may arise. The vagina opens anteriorly into the single bulbose *ovary*. In both of the above species the female becomes greatly swollen when gravid. Information presented below indicates that, at least in the more specialized pyemotids, the above anatomical details are probably oversimplified and that a separate oviporus is present in at least some forms.

Certain sclerites or genital thickenings found in cleared specimens have been largely ignored by earlier authors. The functions of these structures are not presently known but their presence and shape are useful in classification. In the Pyemotinae (except for some *Siteroptoides*) and Acarophenacinae, such sclerites are usually indistinct, except that rodlike, globular, or omega-shaped structures are often found in *Pyemotes, Trochometridium,* and *Siteroptes.* These latter structures have been thought to be spermatophores (Pätau, 1936) or spermathecae. Species of *Siteroptes* and *Trochometridium* possess, in addition, a subapical, circumvaginal sclerite which may be subglobose to elliptical in shape.

Members of the Pygmephorini possess a variety of distinct sclerites in addition to this vaginal sclerite. In the Microdispini and Neopygmephorini, and in some Pygmephorini, one or more of three genital sclerites may be present; these are probably homologous between species. For the sake of convenience, they are designated simply as the anterior, median, and posterior sclerites. These sclerites vary somewhat in shape and distinctness between species and even between specimens of the same species (due to mounting) yet are usually recognizable and useful in classification.

The *anterior genital sclerite* is usually long-triangulate, sometimes appearing to be folded flaplike, its apex directed anteriorly. It arises near a line drawn between the posteromesal margins of coxal foramina IV except in *Pygmephorus* and some *Pediculaster* in which it arises well behind this line.

The *posterior genital sclerite* is situated well behind the anterior genital sclerite and anterior to any apical vaginal sclerotization or structure. It is usually well defined and elongate straplike, or triangular. If triangular, it is also folded, flaplike, and seemingly arises from the anteroventral margin of the cuplike fifth segment. In the more primitive Pygmephorini this sclerite is usually not separable from several accompanying ones and may be absent entirely.

The *median genital sclerite* (fig. 91) is a round, triangular, or irregularly shaped structure situated between the two preceding sclerites. It is present only in *Acinogaster* and in some *Parapygmephorus.*

Structural modifications associated with physogastry. Physogastry, the monstrous enlargement of the body of gravid female mites, has been previously thought to occur throughout the family Pyemotidae to about the degree well known in the genus *Pyemotes.* Although much work remains to be done on this problem, seemingly the extent of such physogastry varies greatly among the genera of the family. Moreover, the areas of the body entering into physogastry differ quite markedly in different genera.

Genera known to swell to several hundred times their original volume include all of the genera of the Pyemotinae and of the

Acarophenacinae except *Caraboacarus* and *Adactylidium* (about which information is not available), and at least some species of *Pediculaster* and *Perperipes*. The latter genus is of particular concern here and will be mentioned later.

Females of *Pygmephorus* are known to swell considerably but seemingly to a lesser extent than the genera mentioned above. The same is probably true for *Microdispodides* and some *Parapygmephorus*, although specific information concerning them is not available. As regards the Microdispini, all gravid specimens of *Microdispus* and *Peponocara* studied by this author contained only one or two large eggs and showed only a slight increase in body size. This situation is nearly identical to that occurring in the genus *Imparipes* of the family Scutacaridae. On the other hand, *Perperipes*, which is considered to be one of the most specialized forms within the Microdispini, becomes enormously physogastric. However, its physogastry is believed to differ considerably from that found in the Pyemotinae (see below).

In the groups exhibiting pronounced physogastry, three main types of this condition, based upon the location and extent of the areas involved, may be recognized.

(1) Opisthosomal physogastry. In this type the metapodosoma enters only slightly into the swelling and pleated conjunctival bands between the propodosoma and hysterosoma are absent or weakly developed. Swelling therefore occurs only in the opisthosoma, this region becoming enormously distended and spherical. As far as known, physogastry of this kind occurs only in the genus *Pyemotes*.

(2) Hysterosomal physogastry. This is the most common type found within the family, the entire hysterosoma becoming swollen and spherical. A distinct band of pleated conjunctiva is usually present between the propodosoma and hysterosoma. This type of physogastry is known to occur in *Dolichocybe, Siteroptes, Trochometridium, Resinacarus, Pediculaster*, and, to a lesser extent, in *Pygmephorus*.

(3) Idiosomal physogastry. This type is restricted to the more specialized members of the Acarophenacinae (*Acarophenax, Paracarophenax*, and probably *Adactylidium*) in which the propodosoma is bipartite in the manner described previously (p. 49) and therefore enters into the swelling. The entire body, except for the greatly reduced gnathosomal portion (including the arcula of the propodosoma) is therefore affected.

In the physogastric females thus far examined, it is obvious that most of the gross enlargement of the body which accompanies the development of the ova takes place in the intersegmental conjunctiva, since measurements of the sclerites indicates that these do not change appreciably in size. What proportion of this conjunctival enlargement is due, however, to the unfolding of the conjunctival pleats and what proportion to conjunctival elasticity is not known. Richards (1951) pointed out that cuticle varies considerably in this regard, elasticity being correlated with the degree of orientation of the micelles, and it is possible (as in Ixodides) that considerably more elasticity occurs in the cuticle than has been heretofore supposed.

Physogastry in Perperipes. The physogastric females (figs. 8, 9) of this genus differ greatly from those of all other pyemotids, and apparently are mimics of the doryline ant larvae among which they live. In these females the pleats of the intersegmental membrane vary in diameter in such a manner that, posterior to the second tergum, they form a regular series of 7 to 9 annuli when extended, these superficially resembling the segments of a larval ant. The fact that these "pseudosegments" may possess spicules like those of maggots leads one to suspect that this mimicry may be further extended to include locomotory or other behavioral characteristics.

During physogastry the female becomes increasingly elongate, although body width remains approximately the same as in the non-gravid form. This elongation takes place only in the following regions: between dorsal segments II and III, between III and IV, and between IV and V. Only a slight separation occurs dorsally between the propodosoma and hysterosoma. Dorsal segments I and II bear the same relationship to each other as in the non-gravid female.

Ventrally, the female is unmodified as far posteriorly as the hysterosomal venter, the latter remaining in its original position at all times. From beneath this sclerite, however, and apparently attached to the hind margin of the posterior ventral plate, there arises a greatly elongate conjunctival area which extends to the posterior end of the venter, where it joins the fifth segment. This area is easily visible in cleared specimens of non-gravid females as a thick band of conjunctival pleats. In physogastric specimens, its anterior portion, located directly behind legs IV and beneath the hysterosomal sternum, is distinctly convex and has a longitudinal slit, the *oviporus*, along nearly its entire length. This convex portion, herein designated as the *oviporal plate* (fig. 8), is darker and more brittle than the more posterior portion of the ventral conjunctiva and is separated from it by an apodemelike ring which is not distinct in all specimens. This ring occurs ventrally in the region of the posterior genital sclerite and joins the posterior margin of the second hysterosomal tergum dorsally, thus, in effect, dividing the entire mite into two areas.

The anterior of these areas is bulbose and slightly larger in girth than the posterior and, because it is composed nearly entirely of sclerotized plates, appears somewhat darker than the latter. It superficially resembles the head of a larval coleopteran or nematocerous fly. The posterior portion is composed almost entirely of conjunctiva except for the widely separated terga III to V. As mentioned above, this conjunctiva is constricted at regular intervals at and between the true segments, giving the female a segmented appearance. Numbers of these "pseudosegments" appearing between the true segments are as follows: two or three between segments II and III; three between III and IV; one or two between IV and V. Segment V is always situated apicoventrally or ventrally.

The origin of the oviporus is unclear. Its anterior termination is seemingly marked by the anterior genital sclerite, its posterior termination by the posterior genital sclerite. It is not visible in non-gravid females. It is probably either a modification brought about by and unique to the gravid state or, as seems more likely, is always present in the pleated conjunctiva of non-gravid forms, becoming definitive during the unfolding of the latter. Its length is such that it would extend beyond the hind margin of the body in non-gravid forms. Its elongation is brought about by the posterior migration of the posterior genital sclerite, the anterior sclerite remaining in the same position as in the non-gravid form.

Musculature in Perperipes. Two sets of longitudinal muscles are seen to pass through the first tergum to connect the posterior dorsum of the propodosoma with tergum II. Terga II, III, and IV are connected to each other by two similar sets of muscles, these capable of elongation to permit the expansion of the body in these areas. A single pair of muscles connects the fourth tergum with segment V. All longitudinal muscles arise anterior to the setal bases.

In addition to the longitudinals, dorsoventral muscles are present as follows: (1) three pairs between the first tergum and the venter, the anterior pair originating upon the posteroventral margin of the anterior ventral plate, the mesal pair upon the lateral prolongation of apodemes III, and the posterior pair upon the posterior ventral plate anterior to coxae III; (2) one pair between the second tergum and coxae III; and (3) one elongate pair between the third tergum and the oviporal plate, immediately behind the posterior genital sclerite. No dorsoventral muscles were seen between tergum IV and the opisthosomal venter or segment V.

If these muscles are indicative of the primitive relationships between the terga and sterna of true segments, it is clear that at least the ventral division between propodosoma and hysterosoma is of a secondary nature. As regards the relationship between the third tergum and the oviporal plate, it is possible that this plate represents the invaginated third sternum, the opisthosomal sternum therefore representing the sternum of the fourth segment.

In view of Mitchell's (1955) findings in the Unionicolidae as well as the observations mentioned earlier (p. 47) concerning the stability of muscle attachments, any speculation based largely or entirely upon these would seem questionable.

Reproductive organs of Perperipes. The most striking feature of this system and one not visible in non-gravid females is the large, muscular *oviduct,* whose external opening is the oviporus. Within this duct fully formed larvae may be seen, these still within the chorion. More or less within the center of the greatly enlarged *uterus* and in direct access to the *oviduct* are the most mature embryos, these decreasing in maturity as one proceeds posteriorly. On each side of the uterus and lateral to the oviduct a germarium is present, the embryos showing a progressive increase in maturity as they move from this region posteriorly to the tip of the hysterosoma. In the most posterior portion of the uterus the embryos from each side merge to form a single stream moving anteriorly into the oviduct.

The true vulva, still visible in segment V, appears to be dissociated from the uterus. It clearly does not function in oviposition.

Legs. The legs of pyemotid mites may be composed of either four or five segments. As explained earlier, this author has chosen to call the most basal free segment the *coxa,* this segment therefore corresponding to that designated as trochanter or trochantofemur by most European workers. The next proximal segment is weakly to strongly subdivided, this being most noticeable on legs III and IV. This segment is called the *trochanter* herein. The remaining segments, *femurogenu, tibia,* and *tarsus,* are named in order beginning with the most basal, their nomenclature corresponding with that in use by most European acarologists. The pretarsus is not considered herein to be a segment. In cases where one segment is lost, the loss is due without exception to the fusion of tibia and tarsus. This fusion occurs in leg I of all Acarophenacinae but *Caraboacarus,* in the genus *Resinacarus,* and in all Pygmephorinae. *Caraboacarus* is unique in having tibia and tarsus IV fused, the line of fusion still visible.

The articulation of the legs (notably that of I and IV) to the body undergoes an interesting evolution within the different genera. In the Pyemotinae and in the less specialized Pygmephorinae (some *Pygmephorus,* some *Pediculaster*) legs I are carried straight forward and their articulations (as seen in ventral aspect) are at approximately a right angle to the longitudinal axis of the body. Within the Acarophenacinae and Pygmephorinae, a parallel transition to an oblique type of articulation occurs, this transition seemingly quite abrupt in the former group. Whether the change in the carriage of this pair of legs is correlated with a corresponding change in their function is not known.

In the more primitive Pyemotinae, *e. g., Dolichocybe, Pavania, Pyemotes, Metasiteroptes,* as well as in most Acarophenacinae, coxae IV are triangular and similar to coxae III in shape and points of articulation, and therefore in movement. In these groups, two ventral condyles, one at the anterior, one at the posterior extremity of the coxa permit the entire leg to be abducted and adducted at approximately a right angle to the longitudinal axis of the body. Flexion-extension is accomplished at the coxo-trochanteral joint. In the higher Pyemotinae and in the entire Pygmephorinae, coxa IV differs from coxa III greatly in shape, number and position of condyles, and in function. In these mites the coxa becomes quadrate (*Siteroptes, Trochometridium*), then rectangulate and greatly flattened (most Pygmephorinae). In the latter, the coxal foramen is nearly slitlike and the base of the coxa becomes increasingly covered by the posterior ventral plate. Concurrently, there is a gradual posterior migration and accompanying enlargement of the anterior sternocoxal condyle until, in the Pygmephorinae, this condyle is found on the inner surface of the posterior ventral plate near the center of the coxal base, where it projects dorsally into a socket on the ventral surface of the latter. In some but not all Pygmephorini the posterior condyle seemingly is vestigial or lost. It appears that in these forms the capability for abduction-adduction of legs IV has become restricted and may be, in some cases, partially replaced by one for flexion-extension. In this respect, these mites show a close affinity to those of the family Scutacaridae.

Tarsi I to IV vary in the number and development of the claws, these oftentimes being of diagnostic value. Tarsus I bears zero to two, the latter condition being present only in the genera *Pavania* and *Dolichocybe,* the former having arisen independently in a number of genera. The usual number of claws on this leg is one and the pulvillus is lacking except in the form designated herein as *Dolichocybe fusiformis* (Krczal, 1959), and in *Pavania.* Claw I may be sessile or pedicellate in varying degrees. It is usually enclosed basally within a membranous or sclerotized cuplike pretarsus which may be elongate along its inner margin to form an opposable "thumb." The latter may be absent (*Siteroptes,* most *Pseudopygmephorus*) to well developed (most *Pygmephorus*) and may be entire, dentate, or cleft for the reception of the claw. In *Trochometridium,* two thumbs are present, one of which is setalike and perhaps is not of pretarsal origin. This thumb may be capable of movement.

In many forms in which claw I is sessile, its position is twisted or otherwise distorted. The pedicel is always present and usually long and slender in those forms in which the thumb is absent.

Claw I may be tiny and subsetiform (some *Myrmecodispus*) to very large (*Pygmephorus*) and it may be simple and hooklike (*Siteroptes,* some *Pseudopygmephorus*) or bulbose basally (many genera).

A general correlation exists between the size and shape of claws I and the occurrence of phoresy. Notable exceptions occur in *Caraboacarus, Peponocara,* and *Glyphidomastax,* in which the claws are lacking. Phoresy is only rarely known in species in which claws I are long-pedicellate or simple and hooklike.

The ambulacra of legs II and III are invariably identical in shape, both claws and pulvilli being present except in *Acarophenax* and *Adactylidum,* in which the claws are lacking. If present, the claws of these legs are always paired and may be simple, cleft, or toothed. The pulvillus is disclike or flaplike, usually longer than the claws. Tarsus IV resembles tarsus I in having lost the claws independently in several genera (*Caraboacarus, Acarophenax, Adactylidium, Microdispodides, Glyphidomastax, Perperipes*) but differs in retaining the pulvillus after such a loss. Claws IV, if present, are often reduced in size and are only rarely cleft or dentate.

In several genera, a round or irregularly-shaped thickened area may be present on tibiotarsus I. This area is mediolateral in location, usually arising between solenidia 2 and 3, and perhaps is associated with the fusion of the tibia and tarsus. It may appear dorsal, circular, and well separated from the lateral margin of the segment, or marginal and irregular.

Setation. The number and placement of leg setae are useful in classification at both the specific and higher category levels. Krczal (1959b) has mapped and attempted to homologize these setae. The practical benefit derived therefrom is great and the setal nomenclature proposed by Krczal is used in this paper (figs. 10-12). It should be pointed out, however, that considerable shifting of these setae may occur, and in addition certain tactiles may be replaced by sensory setae and *vice versa.* The identification of homologues must therefore be viewed with reservations.

Coxae I to IV always bear one seta except in *Dolichocybe, Pavania,* and in some *Adactylidium,* in which coxal setae are lacking. The setation of the remaining segments differs considerably between legs and is best discussed by reviewing the latter in sequence.

Trochanter I bears four setae in the Pyemotinae except for *Trochometridium* (which has five), in the higher Acarophenacinae, in *Pediculaster,* and in some *Pygmephorus,* all other forms bearing three. The structure of seta *c* (the apicolateral dorsal) of this segment is variable, being setiform in the Pyemotinae, Acarophenacinae, and Microdispini, but stout, elongate, and obtuse or spatulate apically in *Pediculaster,* and short, bladelike, and usually proflexed apically in the remaining genera. This same seta undergoes further modification in the family Scutacaridae (Beer and Cross, 1960). Seta *d* (the apicomesal dorsal) of this segment may be setiform or modified and undulate. Trochanter II usually bears three setae (two in *Dolichocybe*), trochanter III from one to three, and trochanter IV two or, rarely, one.

Femurogenu I bears three or four tactiles except in *Dolichocybe* and *Pavania,* which have only two. Femurogenu II possesses from one to three, femurogenu III from one to three but usually one less than the number found on femurogenu II, and femurogenu IV one or two.

Tibia I, if separate, bears five or six tactiles and two solenidia (nos. 1 and 2 of Krczal, 1958). Tibiae II to IV invariably bear four tactiles and zero, one, or two solenidia in addition. The usual number of such solenidia is one (Solenidium 1 of the leg concerned) and if two are present (only on tibia II of some *Parapygmephorus*) then one arises from the apical margin of the segment and is undoubtedly the basal tarsal solenidium (Solenidium 2). The single true solenidium (1) of the tibia becomes lost more often from leg III than from leg II and from leg IV more often than from leg III. Genera lacking this solenidium on leg III are *Paracarophenax* and some *Pyemotes*, while the same solenidium is absent from both legs II and III of the genera *Dolichocybe*, *Acarophenax*, and *Adactylidium*.

Tarsus I, if distinct, bears 13 to 15 setae, six to nine of which are tactile. Tarsus II bears from five to eight tactiles and a single solenidium which is invariably present except in some *Parapygmephorus* where it may arise from the tibia (above). Tarsus III bears from four to eight tactiles and always lacks a solenidium. Tarsus IV bears from three (*Adactylidium*) to seven (*Trochometridium*) tactiles, the usual number being six. Solenidia are always absent on tarsus IV.

In the subfamilies Pygmephorinae and Acarophenacinae except for *Caraboacarus*, and in the pyemotine genus *Resinacarus*, tibia and tarsus I are fused. In these genera the total number of setae varies between 17 and 21. The two short, lateral, usually clavate solenidia found on each of the two original segments (solenidia 1 to 4) are easily recognizable and provide landmarks for further setal recognition. In the Pygmephorinae and in the family Scutacaridae, certain sensory setae may be borne upon distinctive cylindrical or irregularly-shaped pedicels termed *pinnacula* herein. The number, shape, and setal complement of these structures may be useful in classification at specific or generic levels.

The setal designations of Krczal probably oversimplify the true setal picture of this compound segment since, in reality, about half the setae, particularly those of the lateral surface, are rodlike sensory setae, many so closely resembling tactiles as to be nearly indistinguishable from them.

It is obvious that use of such terms as “tactiles” is quite arbitrary and merely follows custom; nothing is known of the functions of the various sensilla.

MORPHOLOGY OF THE MALE

General

As in the remaining Tarsonemoidea, a great deal of dimorphism occurs between the sexes. Unlike the remaining families, however, in which this dimorphism is usually uniformly established to a high degree, males of the Pyemotidae show a sequence of modification from which one may speculate upon probable relationships occurring within the superfamily.

This sequence begins with *Dolichocybe* and terminates along one phyletic line with the Neopygmephorini and the Scutacaridae, males of these two being indistinguishable from each other at the present time. A second line of descent, less clear than the preceding, seemingly passes from a *Dolichocybe*-like form to the Acarophenacinae. Mites of this subfamily show many affinities to the Tarsonemidae and the Podapolipodidae but their relationship to these two families is not clear.

Although *Dolichocybe* is considered here to be primitive, even in this form a great deal of morphological disparity occurs between the sexes. In addition to primary sex modifications, this dimorphism involves body shape (the female being elongate and cylindrical, the male much shorter and stouter), gnathosomal shape (more elongate in females), the length of the legs (comparatively longer in the female), the loss of the pseudostigmata in the male (a pair of setae is present which are probably their homolgues, however), and very minor setal differences on the legs. When compared with the extreme modifications of males in other genera, however, the males of this genus are relatively unspecialized.

Because of the lack of material, males being rare in many species, a more detailed study of the comparative morphology of the males of the family is unfortunately not possible at this time. The following is based on information obtained from the study of the males of the following: *Dolichocybe keiferi; Pyemotes* (one species); *Siteroptes, s. str.* (four species); *Trochometridium tribulatum; Neopygmephorus, s. str.* (one species). In addition, males of several unidentified species of Pygmephorinae as well as of the families Scutacaridae and Tarsonemidae were also utilized for comparative studies. The drawings and descriptions of the males of *Acarophenax, Paracarophenax,* and *Resinacarus* (found respectively in Newstead & Duvall 1918, Rack 1959, and Vitzthum 1927) have provided additional information.

As in the females, taxonomic separation of the males of the more primitive genera is seemingly quite simple, that of higher genera less so. Perhaps, in the case of the males, this is illusory because of the few species available for comparison.

Gnathosoma

This region may be functional and developed to varying degrees (*Dolichocybe, Pyemotes, Resinacarus, Acarophenax, Paracarophenax*, all Tarsonemidae and Podapolipodidae) or completely reduced and nonfunctional (*Trochometridium, Siteroptes, Neopygmephorus*, two other unidentified Pygmephorinae, and all known Scutacaridae). In the latter case, this region consists only of one or two lobes bearing several pairs of setae. The oral opening, mouthparts, and palps are completely lacking when the gnathosoma is reduced.

In forms in which the gnathosoma is well developed (*Pyemotes, Dolichocybe*), its setation is similar to that of the female. In the latter genus the gnathosoma is shorter and broader than that of the female and differs otherwise in having the palps fused to the gnathosoma. The pharyngeal pump and esophagus is distinct in males of this genus despite the fact that the chelicerae are not visible.

Propodosoma

This region is always wider in the male than in the female. The dorsum of males differs from all females except those of *Dolichocybe* and *Pavania* in lacking peritremes, and indeed, all traces of stigmata. Males further differ from all females, except those of the specialized Acarophenacinae, in lacking pseudostigmata. In all genera observed except *Trochometridium*, however, an extra (fourth) pair of propodosomal dorsals occur which may well be the homologues of these organs.

The propodosomal venter resembles that of the female in setal number except in the Pygmephorinae. Generally speaking, the apodemes of the anterior ventral plate resemble those of the female. Males of *Neopygmephorus* differ from their females in that their first coxae articulate in the primitive manner, *i. e.*, at a right angle to the longitudinal axis of the body. In all other genera studied the sexes agree in this respect.

The posterior margin of the male propodosoma usually meets, or is separated by a wide zone of conjunctiva (*Trochometridium*) from, the hysterosoma. It neither covers nor is covered by the anterior margin of the first hysterosomal tergum.

Hysterosoma

Like that of the female, the male hysterosoma is capable of undergoing great modification in many, if not most, areas and organs. These modifications generally seem to be adaptively correlated with the use and disuse or modified use of the legs and genitalia.

Only in *Dolichocybe* does the male retain a close resemblance to the female in numbers of segments and setae. In this genus four bandlike dorsal segments are visible, the fourth apparently covering a reduced fifth which may be fused with the opisthosomal venter. The number of dorsal setae resembles that of the female. In all remaining genera a fusion of terga I and II has occurred, the maximum number of dorsal plates therefore being three. In *Paracarophenax* and *Resinacarus* tergum III appears to be terminal, but in the remaining genera this sclerite is subterminal and platelike. It bears one (rarely) or the usual two pairs of setae. The males of *Acarophenax, Paracarophenax, Dolichocybe, Trochometridium,* and *Resinacarus* are broadly rounded or broadly truncate posteriorly. In these forms the opisthosoma is not greatly constricted or otherwise modified into a globular or conical copulatory structure. In the first two genera above, the aedeagus is displaced ventrally and emerges from a *genital plate* which may consist of portions of tergum IV and segment V. In *Dolichocybe* and in *Trochometridium* the genital aperture is ventral and terminal but the latter genus differs from the former in that a terminal concavity exists between segment IV and segment V, the latter bearing the aedeagus.

In *Pyemotes, Siteroptes, Neopygmephorus,* and in at least some Scutacaridae, tergum IV, segment V, the opisthosomal venter, and perhaps some phallic structures associate to form a conelike or subglobular *genital capsule.* Since the gnathosoma in these forms is vestigial and because the aedeagus is prominent and often bipartite, this capsule easily may be mistaken for the gnathosoma. The genital capsule may be relatively small and subtruncate or concave apically (*Pyemotes*) to very large and acuminate (*Neopygmephorus*). Tergum IV forms the dorsal plate of this capsule. This tergum is seemingly modified for the reception of the female opisthosoma during copulation and may be roughened, punctate, concave, or provided with membranous "wings." It usually bears two pairs of basal setae, of which at least one pair is sensory. Apically, tergum IV encloses the fused fifth segment and opisthosomal venter, these last containing the male genital orifice. At least in *Neopygmephorus*, these last two sclerites may be tripartite, the two lateral lobes formed by such a division being flaplike. It is possible that these flaps may further assist in positioning the female prior to copulation.

The basal portion of the genital capsule is enclosed ventrally by the greatly constricted hind portion of the posterior ventral plate except in *Pyemotes,* in which the ventral portion of the capsule may be free.

Broadly speaking, the arrangement and development of apodemes III and IV found in *Dolichocybe* and *Acarophenax* resemble that of their respective females. In *Paracarophenax* these apodemes are distinctly stronger than in the female. In the remaining genera they are strong, usually complete, and often differ markedly in location and shape from those of their respective females. These changes are probably associated with the modification of legs IV as clasping organs and may reflect corresponding changes in the copulatory position.

In *Dolichocybe, Pyemotes, Acarophenax, Paracarophenax,* and *Trochometridium,* the *penis* is a short, rigid, blunt or hooked organ which is usually divided longitudinally into halves. In *Siteroptes* it is longer, tubular, and acuminate apically but still rigid. The males of *Neopygmephorus* and the scutacarid genus *Imparipes* possess a structure similar to that of *Siteroptes* (fig. 100) but very long and flexible and having taenidia-like thickenings.

The author has studied the internal reproductive structures of *Siteroptes* (*Siteroptes*) *reniformis* Krantz and of an undescribed *Neopygmephorus.* In these species a duct, the *vas deferens,* connects the single *testis* to a globular chamber which probably functions as a combined *seminal vesicle* and *sperm pump.* This chamber is characterized by lateral winglike structures which are probably dilator muscles. The tubular *ejaculatory duct* connects the pump with the intromittent organ. In S. *reniformis,* while this duct appears superficially to open ventrally into the penis about halfway along the latter's length, closer inspection reveals that it doubles back to join the penis at its base, therefore allowing protrusion of that organ without imposing strain on the duct. In *Neopygmephorus* and *Imparipes* this reflexed portion is lacking and the ejaculatory duct is seen to enter the penial base. This arrangement is in keeping with the nature of the intromittent organ, which in these genera is long, flexible, and looped within the genital capsule.

Legs

The legs of male pyemotids may be quite similar to those of their respective females or greatly modified. Generally speaking, the similarities are most pronounced in *Dolichocybe,* least in *Neopygmephorus.* As in the females, and with but few exceptions, legs II and III are the principal locomotory appendages and are therefore thought to retain the least specialized form and setation.

Leg I invariably possess five segments, the setation of the tibia and tarsus closely following that believed by Krczal (1959b) to be primitive (fig. 12). In *Dolichocybe* tarsus I bears two claws, in *Trochometridium* it bears only a membranous flap, and in all remaining known forms, a single claw is present. Trochanter I resembles that of the female as regards setal number but setae *c* and *d* are always setiform.

The angle of articulation of legs I to the anterior ventral plate is the same in both sexes except in *Neopygmephorus* and the scutacarid genus *Imparipes.* In these genera coxa I of the male articulates at a right angle to the longitudinal plane of the body, while in the female it is distinctly oblique.

The relative length of the legs may differ greatly between sexes. In the male of *Neopygmephorus,* for example, leg I is much longer than leg II, while in the female the reverse is true.

Leg II of *Trochometridium* is distinctly larger than leg III. The setation, although similar to that of the female in number, differs distinctly in structure. These changes are probably correlated with the mating behavior of the male (see p. 126).

In *Resinacarus,* leg III is noticeably longer than II and has an elongate, spurlike seta lacking on the former. According to the original description (Vitzthum, 1927), only this leg differs greatly from its female counterpart.

Leg IV closely resembles that of the female only in *Resinacarus* and in *Dolichocybe.* It is distinctly stouter and shorter than its female homologue in *Acarophenax, Paracarophenax,* and *Trochometridium* and usually has at least one modified claw in addition. In the male of *Paracarophenax dermestidarum* (Rack) legs IV are distinctly larger than legs III, but the reverse is true in *Acarophenax tribolii.*

Legs IV are modified forcepslike in all remaining genera studied and are normally carried horizontally and directed toward the rear. Concomitant modifications may occur in the shape and size of the coxa or trochanter IV or both, a shortening of the tarsus, and the simultaneous enlargement of one claw and dimunition or loss of the other. In addition, an accompanying increase in the strength of the posterior ventral apodemes usually takes place. Setation in these forms is similar to that of the female except that one or two tibial setae may be spinelike and that the tarsus may be lacking a seta.

IMMATURE STAGES

Insofar as known, members of the genera *Dolichocybe, Acarophenax, Paracarophenax, Pyemotes,* and *Trochometridium* possess no active immature forms, the adult mite being the only definitive postoval stage. Two free-living immature stages, the hexapod larva and one octapod nymph, have been reported in *Siteroptes graminum* (*vide* Reuter 1900, Cooper 1937, Alfaro 1946), but the appearance of the latter should probably be investigated more thoroughly since it seems likely that the "nymphs" are in reality young females. Fully developed larvae still within the chorion have been observed by the present author in mounted specimens of *Perperipes* and *Neopygmephorus.* In at least one species of the latter genus, the larval stage is not free and the nymphal stage is lacking, since the adult mite may be seen within the skin of the molting larva. This developmental sequence of egg → larva → adult also occurs in at least two species of the scutacarid genus *Imparipes* (G. Bohart and Cross unpublished), although in the latter genus the larval stage is free.

The larvae of two species of *Siteroptes* and a single species each of *Perperipes* and *Neopygmephorus* agree more closely with their males than with their females as concerns the configuration of the anterior ventral plate and the structure of the legs. In *Siteroptes,* however, larvae possess only four pairs of anterior ventral setae while both males and females have six pairs. Larvae of the above three genera further resemble males in lacking tracheae, peritremes, the pseudostigmata, and in possessing an extra pair of propodosomal dorsals which are probably homologues of the latter. Three hysterosomal terga are present and of normal size but the fourth and fifth are reduced and modified to form a pronounced terminal lobe. Setation of the first four segments resembles that of the female. The fifth segment bears at least two pairs of setae.

Although the anterior ventral plate closely resembles that found in the male, the setation and apodemes of the posterior ventral plate differ considerably from those of both adults as might be expected, due to the loss of a pair of legs from this plate.

Leg I is always five-segmented and is articulated to the anterior ventral plate at a right angle to the longitudinal axis of the body. As in the male, setae *c* and *d* of trochanter I are always setiform. Tibia and tarsus I resemble these segments of the male except that the latter always has two claws. Legs II and III likewise resemble those of the male.

PHYLOGENY

In view of the fragmentary knowledge of the Pyemotidae and related groups, this portion of the present work is preliminary. It is included as a beginning from which further speculation may develop.

The construction of a scheme of phylogeny properly supposes a knowledge of ancestral forms, but this is not possible in the Tarsonemoidea owing to the complete lack of a fossil record. Speculations concerning the relationships of the groups were therefore made by less satisfactory means.

The genera were first arranged into higher categories based upon the largest number of characters possible. These characters may be found in Tables III and IV, in the keys, and in the descriptions. Estimates of higher categories which were most closely related were then made by noting the intermediate genera, *i. e.*, genera in one tribe or subfamily sharing the largest number of characters with another tribe or subfamily. Such estimates are probably consciously or subconsciously a part of the procedure followed by most systematists and are usually used to deduce the supposed phylogenetic relationships. Static or phenetic relationships may be much more precisely defined in terms of correlation coefficients among species as done by Michener and Sokal (1957).

Characters were considered to be of two kinds with respect to their usefulness in determining relationship: (1) Those for which no assumptions of primitiveness or specialization were made, and (2) those for which inferences of primitiveness or specialization were made. The former are invariably characters arising within the group or characters whose homologues outside the Tarsonemoidea are uncertain. For example, a single pair of opisthosomal ventral setae is present in a few Pyemotinae, in all Acarophenacinae and Tarsonemidae, but is absent in the remaining Pyemotinae and in all Pygmephorinae and Scutacaridae. The homologues of these setae may or may not be any of a number of similarly located setae found in the groups considered to be most closely related to the

Tarsonemoidea, hence, by comparison cannot be considered to be either primitive or derived. Such characters are nevertheless valid in evaluating phenetic relationships. In a few cases (Table III, males only, and Table IV), particularly when they formed sequences of modification, they were used in association with other characters in the phylogenetic speculation.

Inferences as to the degree of primitiveness or specialization of characters thought to be useful in making phylogenetic assumptions were reached as indicated below:

(1) *By comparison of the various tarsonemoid taxa with non-tarsonemoids considered to be closely related.* For reasons to be mentioned later, the Anystoidea of Cunliffe (1955) are probably more closely related to tarsonemoids than are any other mites and are ancestral to them. The pyemotids of the Tarsonemoidea are most similar to the pseudocheylids of the Anystoidea. Comparisons of characters between members of these two superfamilies, and particularly between the two families mentioned, were considered to be more meaningful than similar comparisons made with groups thought to be more distantly related. Characters found in the anystoids but only some tarsonemoids are considered to be more primitive in the Tarsonemoidea than the alternative characters found only in the Tarsonemoidea. These comparisons present, however, several important difficulties, as follows: (a) Uncertainty does still exist as to the closest relatives of the Tarsonemoidea. The gap between tarsonemoids and anystoids is of sufficient size that explicit lines of descent cannot be recognized. (b) Any repetitive character (*i. e.*, one lost or modified, then regained) or any character that arose independently in different groups may produce similarities resulting from convergence or parallelism rather than phylogenetic relationship. Despite these difficulties, this method of recognizing primitive and derived characters is probably the most reliable and has been used herein wherever possible. Table III lists characters judged on this basis.

(2) *By extension of the premise that phenetic similarity implies relationship.* In certain cases where well-defined sequences of modification in the states (any one of the two-several alternative conditions possible) of a character were present, phenetic characters were used in the determination of phylogeny. In such cases, the sequences were present in two morphologically different lines as determined by numerous associated characters, and the primitive

end of the sequence was considered to be the end common to both. For example, a progressive change in the number of ventral propodosomal setae has occurred within the Pyemotidae. In most of the Pyemotinae six pairs occur but in the Pygmephorinae five and four pairs are the rule, and in the Acarophenacinae four, three, and two pairs are present. The latter number is characteristic of most Tarsonemidae (except for *Tarsonemella*). In this instance, the author has considered the primitive number to be six pairs. Characters whose primitiveness or specialization was determined in this fashion are listed separately in Table IV.

(3) *By a combination of methods 1 and 2 above.* The primitive and derived states of the characters listed for males in Table III were arrived at by combining the two methods above. In this case, anystoid males were not available for study but inferences drawn from comparisons of tarsonemoids with prostigmate forms considered to be more distantly related than anystoids agree with those drawn from observations of sequential modifications, present only in males, in which one extreme contained forms closely resembling the females but the other extreme consisted of forms strikingly different from them. There is, for example, a progressive reduction of the mouthparts followed by the reduction, then loss of the gnathosoma. A parallel sequence concerns certain great modifications of the opisthosoma and copulatory apparatus. In this case, it seems clear that the primitive characters are those most nearly alike in both sexes. Single series of sequential modifications, unless supported by evidence from other sources as in the case of the males above, were not considered in the speculations on the phylogeny.

In the Pyemotidae, certain characters are of special interest in that they appear highly specialized, yet occur only in the genera considered to be primitive. Extreme physogastry, for example, is found throughout the Pyemotinae, Acarophenacinae, and in most Pygmephorini. It is not known to be present in the Microdispini and Neopygmephorini (except in the microdispine genus *Perperipes*) and in the Scutacaridae. A closely related character, the number of active immature stages, follows a similar pattern. In certain pyemotines (*Dolichocybe, Trochometridium, Pyemotes*) as well as in the Acarophenacinae, all immature stages are supressed, the first active stage therefore being the adult. In *Siteroptes* and in all known Pygmephorinae as well as in the Scutacaridae, a definitive hexapod larval stage is interposed between egg and adult.

The occurrence of these unusual characters in forms believed closely related to the Pyemotidae has not been studied but partial physogastry in conjunction with the simultaneous production of at least eight eggs has been observed by the author in one gravid female teneriffiid. Despite their seemingly obvious specialization, such characters must be considered primitive *within the family,* and the return to the less extreme condition as derived. The same treatment is accorded characters which are lost, then regained, both loss and reappearance being considered as specializations.

Groups having a high percentage of the primitive characters listed in Tables III and IV are considered primitive, those having a high percentage of derived characters are considered to be specialized. Further judgment concerning the positions of the various taxa was made after consideration of habits and internal structures.

Table V lists for each subfamily and tribe, in the manner of Sinha (1958), the number of primitive, partially derived (derived in some, but not all species in a group), and derived characters from Tables III and IV. Males are listed separately because they are so poorly known. Table VI indicates the percentage of primitive characters listed in Table III possessed by representative species of each genus. Males are listed separately for the reason stated above.

Relationships of the Tarsonemoidea to other groups. Although at least two ideas regarding the relationships of the group have been popular in the past, all contemporary authors agree that the Tarsonemoidea should be placed in the Suborder Trombidiformes and that its members are most closely related to the Supercohort Prostigmata (see History). The recent discoveries of the primitive genera *Dolichocybe* and *Pavania* have, however, emphasized a possible relationship, hitherto unsuspected, between the Pyemotinae and the anystoid family Pseudocheylidae.

In general, anystoids resemble prostigmates and differ from tarsonemoids in that the cheliceral bases are freely developed and moveable, in possessing well-developed, segmented palps which usually retain the thumb-claw complex, in the position and size of the genital opening, the latter often furnished with suckers in the female, in genital setation, in usually having six or more leg segments, in lacking definite segmentation (although segmentally arranged plates may be present), in usually possessing eye spots, and because (usually?) the males resemble the females.

Alternatives of some of these characters peculiar to the Tarsone-

TABLE III.—List of Primitive and Derived Characters in the Pyemotidae

Primitive	Derived
A. FEMALES	
1. Gnathosoma free	Gnathosoma enclosed in propodosoma
2. Palps free	Palps fused to gnathosoma
3. Palps not elongate, not fitted for piercing	Palps elongate, fitted for piercing
4. Chelicerae small, distinct	(*a*). Chelicerae reduced, not or barely visible (*b*). Chelicerae enlarged, bladelike
5. Stigmata present	Stigmata absent
6. Pseudostigmata present	Pseudostigmata absent
7. Without well defined esophageal pump	Esophageal pump (*a*). in gnathosoma (*b*). in propodosoma
8. Gnathosoma directed forward	Gnathosoma directed at least anteroventrally
9. Propodosomal dorsum just meeting first hysterosomal margin	Propodosomal dorsum distinctly overlapping or being overlapped by first hysterosomal tergum.
10. Propodosoma not divided	Propodosoma divided into two parts
11. Hind margin of posterior ventral plate entire, plate lacking median triangular area	Hind margin of posterior ventral plate tripartite, plate with median triangular area
12. Posterior ventral plate whole	Posterior ventral plate divided longitudinally or transversely
13. Anterior genital sclerite indistinct	Anterior genital sclerite distinct
14. Posterior genital sclerites indistinct or variously shaped but not triangular and flaplike	Posterior genital sclerite triangular and flaplike
15. All legs with five segments	Legs I or IV with four segments
16. All coxae similarly shaped	At least coxae IV differing from the rest in shape
17. All tarsi with two claws	(*a*). Tarsus I with only one claw (*b*). Claws lacking on one or more pairs of legs
18. Seta *c* of trochanter I setiform	Seta *c* of trochanter I modified
19. Tarsus IV similar to tarsi II and III	Tarsus IV more or less elongate, distinctly longer than II or III
20. Claws II-IV alike, simple	Claws II and III basally dilate, often toothed in addition

TABLE III.—List of Primitive and Derived Characters in the Pyemotidae—*Concluded*

Primitive	Derived
A. FEMALES—*Concluded*	
21. Coxa IV not markedly bulbose basally	Coxa IV slightly to markedly bulbose basally
22. Mites pale, soft bodied	Mites sclerotized, harder bodied
B. MALES	
23. Gnathosoma present, well developed	Gnathosoma absent or at least greatly reduced
24. Mouthparts functional	Mouthparts non-functional
25. Genital capsule undeveloped	Genital capsule developed
26. Posterior ventral plate resembling that of female	Posterior ventral plate differing from that of female
27. Dorsal segments I-II distinct	Dorsal segments I-II fused
28. Legs I-III similar to those of female	Legs I-III differing from those of female
29. Legs IV straight, not greatly differing from II and III in length	Legs IV tonglike, often greatly shortened

TABLE IV.—Supplementary List of Primitive and Derived Characters in the Pyemotidae

Primitive	Derived
1. With six pairs of ventral propodosomal setae	With fewer than six pairs of ventral propodosomal setae
2. With three pairs of propodosomal dorsals	With fewer than three pairs of propodosomal dorsals
3. Segment V with more setae	Segment V with fewer setae
4. Posterior ventral plate with six pairs of setae	Posterior ventral plate with fewer than six pairs of setae
5. Trochanter I with four setae	Trochanter I with three or (rarely) five setae

moidea and believed to be derived are as follows: cheliceral bases are fused with the palpal bases to form a gnathosomal capsule in which only the moveable chela seems to function as a protrusible piercing organ, the palps are reduced with segmentation absent or indistinct, the distinct thumb-claw complex is lacking but a more or less palmate apical claw is often present, the female genital opening is apical, the legs possess five or fewer segments, and sexual dimorphism is present, usually marked.

The presence of well-defined body segmentation in the Tarsonemoidea has sometimes been regarded as primitive. Although certain primitive mites of the Anactinochitinosi (*e. g.*, *Opilioacarus*) retain what may be primitive segmentation, there is no account of such segmentation in the Trombidiform-Sarcoptiform group, and in view of their many other seemingly specialized characters, such segmentation may well be secondarily acquired in the tarsonemoids.

Pyemotines resemble pseudocheylids in being elongate and weakly sclerotized, in the shape and position of the peritremes (lost, however, in *Pavania* and *Dolichocybe*) and of the pseudostigmata, in the shape, number of segments, type of pulvillus, and to a surprising degree, the setation of the legs, in lacking genital suckers, and in the setation of the propodosomal dorsum.

Relationships among the families within the Tarsonemoidea. Broad trends of the relationships within the Tarsonemoidea are seemingly plain and were outlined, sketchily, as early as 1901 by Brucker. It is generally agreed that the Pyemotidae are the most generalized family, being most similar to prostigmata and anystoids, and give rise, on the one hand, to the Tarsonemidae and Podapolipodidae, and on the other to the Scutacaridae. The origins of the first two are obscure but their closest living relatives are seemingly found in members of the genus *Pyemotes* and in the subfamily Acarophenacinae (see below). The Scutacaridae, on the other hand, are doubtless specialized forms arising from the Pygmephorinae of the Pyemotidae and are so closely related to them that their present family status may reasonably be questioned. Since females may be satisfactorily separated, and because such a separation simplifies the classification, it is retained herein.

Relationships within the family Pyemotidae. The family is here divided into the three subfamilies, the Pyemotinae, Acarophenacinae, and Pygmephorinae. Of these, the Pyemotinae has the smallest number of derived characters (Tables V and VI). All its mem-

TABLE V.—Number of Primitive and Derived Alternatives of Characters Listed in Tables III and IV

	Primitive	Partly derived	Derived
FEMALES			
Pyemotinae	17	10	0
Acarophenacinae	11	9	6
Pygmephorinae			
Pygmephorini	11	5	11
Microdispini	9	7	11
Neopygmephorini	10	3	14
MALES			
Pyemotinae	1	6	0
Acarophenacinae	3	0	4
Pygmephorinae	0	0	7

TABLE VI.—Per cent Age of Primitive Characters (From Table III) Possessed by Various Pyemotid Species

SPECIES	Percent primitive characters	
	Male	Female
PYEMOTINAE		
Pavania fusiformis		82
Dolichocybe keiferi	100	96
Pyemotes sp.	56	76
Siteroptes macer		91
Siteroptes prob. *graminum*	0	91
Siteroptes (*Siteroptoides*) sp.	0	86
Trochometridium tribulatum	44	76
ACAROPHENACINAE		
Caraboacarus sp.		71
Acarophenax tribolii	56	48
Paracarophenax dybasi	56	48
Adactylidium beeri		48
PYGMEPHORINAE		
Pediculaster americanum		53
Pygnephorus (*spinosus* group)		48
Microdispodides pholidotus		48
Microdispus obovatus		57
Myrmecodispus dorylinis		57
Glyphidomastax rettenmeyeri		53
Perperipes ornithocephala		43
Peponocara cathistes		57
Parapygmephorus halictinis		48
Acinogaster marianae		43
Neopygmephorus sp.	0	38

bers are characterized by five-segmented legs I (except in *Resinacarus*), three pairs of propodosomal dorsals, trochanter I with four setae, of which seta *c* is unmodified, and by coxa I articulating at a right angle to the longitudinal axis of the body. In addition, its presumably most primitive members may possess two claws on tarsus I, have coxa IV similar in shape to that of the remaining legs, have a pair of setae on the opisthosomal venter, and possess (at least in *Dolichocybe* and *Pyemotes*) males having a well-developed gnathosoma, functional mouthparts, and relatively unmodified sexual structures and hind legs.

The subfamily Acarophenacinae consists of a unique group whose members possess only four of the specialized characters listed in Tables III and IV. It shows closest affinities to primitive pyemotine genera in that the adjacent margins of the propodosoma and hysterosoma are contiguous or nearly so, in having a pair of opisthosomal ventral setae (except in *Caraboacarus*), in that coxa IV resembles that of the remaining legs, in the shape and extent of the ventral apodemes, in that the palps may be fused and the chelicerae large, and in the presence of the gnathosoma and relative lack of modification of sexual structures in the male. Except for the genus *Caraboacarus*, the subfamily forms a morphologically distinct group based on the loss of ventral setae, the loss of pseudostigmata, the loss of claws, and in having the male genital opening situated ventrally. *Caraboacarus* alone resembles the more primitive pyemotines in that leg I is five-segmented, in having pseudostigmata, in having the gnathosoma free and not recessed into the propodosoma, and in having the propodosoma entire rather than bipartite. More specialized Acarophenacines resemble the higher pyemotines in having legs I with four segments, trochanter I with three setae, claw I sometimes greatly enlarged and sessile, tarsus I sometimes with a mediolateral sensory spot, and legs I arising oblique to the longitudinal axis of the body. These characters are thought to have been independently derived. All species of acarophenacines whose habits are known are parasites of insects or their eggs.

In the reduction of the ventral setae but retention of the opisthosomal ventrals, in the structure of the ventral apodemes, shape and structure of the propodosoma, position of the stigmata, general size and shape, and in the retention of a functional gnathosoma in the male, members of the Acarophenacinae resemble, and are thought to be closely related to, members of the family Tarsonemidae. The origin of the highly specialized Podapolipodidae is less clear but is probably closest to the tarsonemid-acarophenacine groups. No seemingly primitive members of the Podapolipodidae were available for study and observations of specialized forms, *e. g., Podapolipus,* give little information as to their derivation.

Despite the apparent difference in the number of derived characters between the two groups (due to the fact that some, but not all pyemotines possess derived characters found throughout the Pygmephorinae; see Table V), the distinction between the Pyemotinae and Pygmephorinae is not well defined, a gradual transition occurring between the two groups. The point of division between them is therefore arbitrary and is based upon few characters. Weighting of characters (number of segments of leg I, conformation of seta *c* of trochanter I) has therefore been done deliberately in this case with an eye toward simplification of the classificatory structure.

The relationships of the Pygmephorinae have been obscured by earlier authors, who assigned all known species except the two belonging to the hitherto monotypic genera *Microdispodides* and *Microdispus* to the single genus *Pygmephorus.* Because of the close relationship between the two groups, primitive pygmephorines of the tribe Pygmephorini (the latter containing 11 derived characters) share the following characteristics with at least some specialized members (*e. g., Siteroptes*) of the subfamily Pyemotinae: extreme physogastry, three pairs of propodosomal dorsals, vestiges of the intersegmental line between tibia and tarsus I, four setae on trochanter I, at least apodemes III and IV complete and well developed, apodeme V often present in addition, and leg I articulating more or less at a right angle to the longitudinal axis of the body. All of these characteristics are lost within various members of the tribe, but the last-named is found again, perhaps acquired secondarily, in certain members of the genus *Pseudopygmephorus* of the Neopygmephorini.

The tribes Microdispini and Neopygmephorini are considered almost equally specialized, their origins obscure but near the Pygmephorini. The former contains 11 derived characters, the latter 14.

Microdispines are characterized in that seta *c* of trochanter I is setiform and in having lost, except in some *Premicrodispus,* the second pair of propodosomal dorsals as well as a pair of setae from hysterosomal segment V. In most forms (exception, *Peponocara*) the gnathosoma is elongate and often acuminate, the peritremes are widely separated and troughlike or guttate and the first hysterosomal segment is well developed, usually covering at least the posterior half of the propodosoma. As indicated by general body conformation, the articulations of coxae I, the shape and placement of the ventral apodemes, and the tripartite posterior margin of the posterior ventral plate, some *Microdispus* (*Premicrodispus*) show many characters in common with certain species of *Pseudopygmephorus* but the relationship between the two genera is obscure. The former is considered herein to be the most primitive from within the Microdispini while those forms associated with army ants and culminating with *Glyphidomastax and Perperipes* are thought to be the most specialized. These latter forms are characterized by the hyperdevelopment of the first hysterosomal tergum, the loss of claws from as well as other modifications of leg IV, the elongation of the palps for piercing, and other specializations. Phenetic relationships within the members of the Microdispini are easily established but phylogenetic relationships are obscure.

Most members of the Neopygmephorini differ from those of the Pygmephorini, as well as from most of the Microdispini, in possessing two, rather than one or three pairs of propodosomal dorsals. In addition, seta *c* of trochanter I is bladelike in all forms. Because of the multiple loss and reappearance of many characters, the relationships among the members of this tribe are not clear.

Figure 6 illustrates the author's concept of the relationships within the Tarsonemoidea in accordance with the outline presented above. The horizontal arrangement of categories is a matter of convenience.

DESCRIPTION OF THE FAMILY PYEMOTIDAE

FEMALES

DESCRIPTION. Small mites, 85 to 400µ long, of varying shapes; color pearly-white translucent to brown; chelicerae styliform, enlarged bladelike, or (rarely) vestigal; peritremes usually dorsal and of various shapes, rarely (some Microdispini) in "shoulders" and directed anteriorly, or absent (only in *Pavania* and *Dolichocybe*); propodosomal dorsum entire or bipartite, bearing one to three pairs of setae; pseudostigmata usually present; anterior ventral plate with two to six pairs of setae; with four visible dorsal segments bearing, respectively, two, one, one or two, and two pairs of setae; fifth segment usually present, commonly enclosed by fourth, bearing zero to three pairs of setae; first tergum overlapped by, contiguous with, or overlapping propodosoma, latter condition present to varying degrees but only rarely (*Perperipes, Glyphidomastax*) with free margins which cover the gnathosoma and basal segments of legs I and II; posterior ventral plate with three to six pairs of setae, opisthosomal venter with one pair or none; four pairs of legs always present; legs I four or five segmented, bearing zero to two claws, pulvillus of this leg usually lacking (present only in *Pavania* and *Dolichocybe fusiformis*); seta *c* of trochanter I often modified; leg IV with five segments (tibia and tarsus fused but distinct in *Caraboacarus*) and usually with claws; coxa III usually shorter than coxa IV; trochanter IV invariably much longer than femurogenu IV.

Present knowledge concerning males is too incomplete to merit a formal description; information concerning them can be found on pp. 68-73 (morphology), in the key to the genera of the subfamily Pyemotinae, and in the various descriptions.

Key to the Families of the Tarsonemoidea (Females)

1(*a*). Hind coxa and trochanter short, each much less than half as long as the greatly elongate and cylindrical femurogenu; hind tarsus without claws, terminating in two elongate, whiplike setae; coxa III elongate, always at least twice as long as coxa IV . . . . *Tarsonemidae*

1(*b*). Hind coxa and trochanter longer, each always much more than half as long as femurogenu; hind tarsus present or not and with or without claws; coxa III never more than one and one-half times as long as coxa IV 2

2(*a*). Usually with three pairs of legs or less; if four pairs are present, then the gnathosoma is free and distinct and the propodosoma is not bipartite; pseudostigmata lacking . . . . *Podapolipodidae*

2(*b*). With four pairs of legs; pseudostigmata present or, if lacking, then gnathosoma partly or completely enclosed within propodosoma 3

3(*a*). First hysterosomal tergum greatly expanded anteriorly and laterally so that its free, striate margins project over the gnathosoma and basal segments of legs I and II; segment V with three pairs of setae; seta *c* of trochanter I modified or absent; usually brown, circular to broadly elliptical in dorsoventral aspect . . . . *Scutacaridae*

3(*b*). First hysterosomal tergum of varying shapes and sizes, but as described above only in two genera (*Perperipes, Glyphidomastax*) associated with doryline ants; if margins enlarged, free, and striate, then seta *c* of trochanter I setiform, segment V with two pairs of setae, gnathosoma greatly elongate, palps sharply acuminate . . . . *Pyemotidae*

Key to the Subfamilies of Pyemotidae (Females)

1(*a*). With three pairs of anterior ventral setae or less; pseudostigmata often absent; chelicerae enlarged, distinct; opisthosoma short, usually not longer than distance between anterior margin of coxa III and posterior margin of coxa IV; mites oval or rhomboidal in dorsoventral aspect. . . . *Acarophenacinae*, p. 129

1(*b*). With at least four pairs of anterior ventral setae; pseudostigmata present; chelicerae usually small, indistinct; opisthosoma usually distinctly longer than distance between anterior margin of coxa III and posterior margin of coxa IV; mites variously shaped but only rarely oval or rhomboidal 2

2(*a*). Leg I usually with five segments, if four then coxa IV triangular (*Resinacarus*); coxa I articulated to anterior ventral plate at a right angle to longitudinal axis of body or nearly so; seta *c* of trochanter I setiform .... *Pyemotinae*, p. 86

2(*b*). Leg I with four segments; coxa IV quadrate or rectangulate; coxa I articulated as above or distinctly obliquely; seta *c* of trochanter I setiform or not .... *Pygmephorinae*, p. 147

Subfamily PYEMOTINAE

DESCRIPTION OF NON-GRAVID FEMALE. Mites of small to moderate size, 150 to 400μ long; shape, elongate-elliptical, elliptical, or fusiform; posterior margin of hysterosoma evenly rounded, broadly rounded, or truncate; integument weakly to moderately sclerotized, lacking striae, pebblings, or scalelike engravings.

Gnathosoma. Always free, normally directed anteriorly or rarely anteroventrally, never largely or completely hidden within propodosoma; palps fused to gnathosoma or free and moveable; chelicerae enlarged and distinct or small and indistinct.

Propodosoma. Dorsum. Always entire, pseudostigmata present; three pairs dorsal propodosomal setae; posterior margin of propodosoma only meeting, barely overlapping, or barely overlapped by anterior margin of first hysterosomal tergum; esophageal 'finned" structures present or absent. *Venter.* Anterior ventral plate with four to six pairs of setae.

Hysterosoma. Four to five visible segments, segment V completely enclosed dorsally and posteroventrally by tergum IV or not; segment V with one to three pairs of setae; posterior portion of vaginal wall sclerotized or enclosed in enlarged, elliptical to globose pumplike structure or not; at least one genital sclerite present, its shape variable; opisthosoma not distinctly shorter than distance between anterior margin of coxa III and posterior margin of coxa IV, or if so, then body usually elongate; opisthosomal venter with or without single pair of setae.

Legs. Leg I four (rarely) or five-segmented, if four-segmented then coxa IV triangulate; coxa I, as seen from beneath, articulated at a right angle to the longitudinal axis of the body or nearly so; claws present on legs I to IV; trochanter I with four to five setae, seta *c* setiform; pinnacula absent; coxa IV triangular, quadrate, or rectangulate.

Key to the Genera of the Subfamily Pyemotinae

1(*a*). Males..7

1(*b*). Females..2

2(*a*). Leg I with two claws; peritremes lacking.......................6

2(*b*). Leg I with one claw; peritremes present........................3

3(*a*). Leg I with four segments, tibia and tarsus fused....... *Resinacarus*, p. 128

3(*b*). Leg I with five segments, tibia and tarsus separate...............4

4(*a*). Coxa IV as coxa III, triangular; palps fused to gnathosoma (fig. 21) *Pyemotes*, p. 93

4(*b*). Coxa IV rectangular or quadrate; palps free.....................5

5(*a*). Posterior ventral plate tripartite; claw I sessile (fig. 29)............ *Trochometridium*, p. 116

5(*b*). Posterior ventral plate entire; claw I distinctly pedicellate.......... *Siteroptes*, p. 101

6(*a*). Palps arising ventrolaterally from gnathosoma; chelicerae large, falcate.. *Pavania*, p. 87

6(*b*). Palps arising laterally from the gnathosoma; chelicerae small, indistinct... *Dolichocybe*, p. 89

7(*a*). Tibia III with greatly enlarged spinelike seta which reaches tip of tarsus or nearly so.................................. *Resinacarus*

7(*b*). Tibia III lacking such a seta...................................8

8(*a*). Gnathosoma well developed, or if reduced, functional (figs. 15, 23)...9

8(*b*). Gnathosoma reduced to a lobe, mouthparts lacking (figs. 27, 99)...10

9(*a*). Leg I with two claws; leg IV normal (fig. 15).......... *Dolichocybe*

9(*b*). Leg I with a single claw; leg IV modified, tonglike........ *Pyemotes*

10(*a*). Leg I with single pedicellate claw; propodosomal dorsum with four pairs of setae.. *Siteroptes*

10(*b*). Leg I with only broad, flaplike pulvillus; propodosomal dorsum with three pairs of setae............................ *Trochometridium*

Pavania Lombardini

(Figs. 17-18)

Pavania Lombardini, 1949, Redia (Firenze), 34: 67-74. Type, *Pavania fusiformis* Lombardini, 1949, by original designation.

This monotypic genus is very closely related to *Dolichocybe* Krantz, resembling the latter in that the peritremes are lacking or at least not visible, in that the opisthosomal plate is bipartite, each portion bearing an indentation or suckerlike structure, in the structure and conformation of the terminal opisthosomal segments, in the conformation of the coxae, in lacking coxal setae, and in posessing two claws on leg I. It differs from *Dolichocybe* in various gnathosomal characteristics, chiefly in the structure and size of the chelicerae and in the position and size of the palps. Members of both genera are considered to be among the most primitive of known pyemotids.

Only the non-gravid females are known.

DIAGNOSIS. Females separable from those of all other genera except *Dolichocybe* in possessing two claws on leg I and because they lack visible peritremes. They differ from those of *Dolichocybe* in that the palps arise ventrally rather than laterally and because the chelicerae are greatly enlarged and falcate.

DESCRIPTION OF NON-GRAVID FEMALE. Length, approximately 120μ; width, approximately 68μ; distance between anterior sternocoxal condyles of coxae III, approximately 47μ; body moderately sclerotized, coarsely punctate.

Gnathosoma. Elliptical in dorsal aspect, only slightly longer than wide, directed anteriorly; palp subconical, movable, arising from the ventral surface, bearing distinct apical tooth and two small ventral solenidia; chelicera greatly enlarged, falcate; ventral pharyngeal-esophageal pump absent, a series of beadlike esophageal structures present.

Propodosoma. Dorsum. Inversely U-shaped, expanding laterally at points of articulation of legs I and II; foramen opening anteriorly; posterior margin meeting but not projecting over or covered by first hysterosomal tergum; pseudostigmata present, located in anterior one-third, external pseudostigmatal socket subquadrate in shape; posterior pseudostigmatal setae at least twice as long as either of two remaining pairs; peritremes not visible, probably absent; distinct esophageal "finned" structures lacking in propodosoma. *Venter.* Anterior ventral plate with six pairs of setae, ventrites I and II each with three pairs; external ventral I not forked; apodemes II increasingly distinct at the sides, bending posteriorly near the midline, incomplete; anterior median apodeme complete, distinct; each posterior marginal apodeme indistinctly arcuate; band of pleated conjunctiva present ventrally between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment entire, meeting but not overlapping propodosomal dorsum; fourth segment enclosing fifth and closely associated with it, bearing two pairs of setae, one pair very long; fifth segment reduced, ventral, bearing large, slitlike vulva, the latter flanked by one pair of short setae. *Venter.* Posterior ventral plate elongate, entire, well defined anteriorly, bearing six pairs of setae; hind margin of posterior ventral plate entire, broadly rounded; second axillary arising from apodeme IV immediately mesad of anterior sternocoxal condyle IV; external presternals well behind and slightly laterad of internal presternals;

external poststernals close behind but well mesad of posterior margin of fourth coxal foramina; apodemes III distinct, procurved, not reaching midline; apodemes IV strongest laterally, weakly sigmoid, directed anteromesally; apodemes V lacking; posterior median apodeme weak, barely furcate posteriorly, terminating on level with internal presternals; opisthosoma (dorsally between segments III and IV, ventrally behind the posterior ventral plate and behind the opisthosomal venters) with bands of pleated conjunctiva; opisthosomal venter divided, forming two lateral "ears," each bearing a single seta and an oval, granulose disc; an antevulvar plate present in front of segment V, bearing two pairs of tiny setae and an internal sclerite; opisthosoma distinctly shorter than distance between anterior margin of coxa III and posterior margin of coxa IV.

Legs. Rather stout; leg I slightly longer and distinctly thicker than leg II, five-segmented; tarsus I rectangulate, narrower than femurogenu I; lateral sensory spot absent; claws I paired, sessile, moderately developed, not dilate basally, a short, flaplike pulvillus present between them; trochanter I with four setae; trochanter II with two setae, femurogenu II with one; trochanter III with one seta, femurogenu III with one; tarsi II and III each with six tactiles; solenidium of Tibia III absent; claws II-IV moderately stout, simple, subequal in size; pulvilli II-IV well developed, longer than claws; coxa III and IV similar in size and shape, elongate-triangular when viewed in inner ventral aspect; tarsus IV similar in size and shape to tarsus III; ratio of femurogenu IV to tarsus IV approximately 1 to 1.7.

HABITS. Unknown. Known only from *Scarabaeus sacer* L. (Coleoptera, Scarabaeidae).

DISTRIBUTION. Known only from the type locality.

SPECIMENS EXAMINED. *P. fusiformis,* Tortona, Italy, June, 1947, on *Scarabaeus sacer* L. (Syntypes).

Dolichocybe Krantz

(Figs. 13-16)

Dolichocybe Krantz, 1957, Ann. Ent. Soc. Amer., 50: 259-264. Type, *Dolichocybe keiferi* Krantz, 1957, by original designation.

As mentioned previously (p. 87), this genus shows a close relationship to *Pavania* Lombardini. It is retained herein largely because of the structure of the chelicerae and palps.

The author has not seen the form described as *P. fusiformis* by Krczal (1959b, p. 565) but comparison of its description with syntypes of *fusiformis* indicates that it is a new species which is here tentatively placed as a second species of *Dolichocybe* until further work clarifies the status of these two genera.

In addition to the females of both species, gravid females and males of *D. keiferi* are known.

DIAGNOSIS. Both sexes are immediately separable from all other members of the family except *Pavania* because tarsus I bears two claws. Females differ from those of *Pavania* in that the palps arise laterally from the gnathosoma and because the chelicerae are small and needlelike rather than enlarged and falcate.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 140 to 190μ; width, 40 to 65μ; distance between anterior sternocoxal condyles of coxa III, 28 to 32μ; hysterosoma elongate-elliptical to subcylindrical; body very weakly sclerotized, without coarse punctae.

Gnathosoma. Ovate or elongate-rectangulate, normally directed anteriorly; palp palmate or elongate, if as latter, then cylindrical, bearing four to five short tactile and sensory setae, the most distinct of which is apical and falcate; palp movable but articulations indistinct; chelicera minute, indistinct; large, irregularly elliptical circumesophageal mass indistinctly present, this not distinctly ventral or bulbose as described for *Pyemotes;* esophagus narrow, straight, often indistinct.

Propodosoma. Dorsum. Rounded or oval, expanding laterally at points of articulation of legs I and II, anterior margin forming cylindrical "cervix" which encloses only gnathosomal base; foramen anterior, foraminal collar absent; posterior margin meeting but not prejecting over or covered by first hysterosomal tergum; pseudostigmata present, located in anterior one-third; posterior pseudostigmatal setae at least twice as long as either of other pairs; peritremes not visible, probably absent; esophageal "finned" structures absent. *Venter.* Anterior ventral plate with six pairs of setae, ventrites I and II each with three pairs; external ventral I not forked; apodemes II weak, often indistinct, gently arcuate posteriorly, incomplete medially; median apodeme appearing excavated groovelike; posterior marginal apodemes indistinct; large band of pleated conjunctiva present ventrally between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment entire, meeting but not overlapping propodosomal dorsum; fourth segment enclosing apex of hysterosoma, bearing two pairs of setae, one pair very long; fifth segment closely associated with fourth, reduced, ventral, bearing vulva, the latter flanked by a pair of short setae; antevulvar plate present ventrally in front of segment V, bearing two pairs of tiny setae and an internal sclerite. *Venter.* Posterior ventral plate elongate, poorly defined anteriorly; median trigonal portion of posterior ventral plate lacking but latter indistinctly divided into three sections, (fig. 13 and Krczal, 1959b. p. 566) the two anterior each surrounding one of coxae III, the posterior enclosing both of coxae IV (the margins of these sections do not correspond to the ventral apodemes, which are separately distinct); posterior ventral plate with six pairs of setae, its hind margin produced mesally into a flaplike lobe; second axillary arising from apodeme IV immediately before the anterior sternocoxal condyle of leg IV; external presternals well behind and slightly laterad of internal presternals; external poststernals close behind but well mesad of posterior margin of fourth coxal foramina; apodemes III short, recurved posteriorly, not reaching midline; apodemes IV equally short, directed nearly mesad; apodemes V lacking; posterior median apodeme absent; opisthosoma (dorsally between segments III and IV, ventrally behind the opisthosomal venter) with a wide band of distinctly pleated conjunctiva; opisthosomal venter divided, forming two lateral "ears" which join but do not fuse with median lobe of posterior ventral plate, each piece bearing a single seta and an anteromedian depression; opisthosoma shorter than or as long as distance between anterior margin of coxa III and posterior margin of coxa IV.

Legs. Short and slender; leg I slightly longer and distinctly thicker than leg II, five-segmented; tarsus I rectangulate, never wider than femurogenu I; lateral sensory spot absent; claws I paired, sessile, moderately developed, not dilated basally, pulvillus present or lacking; trochanter I with four setae, seta *c* long, setiform; trochanter II with two setae, fermurogenu II with one; trochanter III with one seta, femurogenu III with one; tarsi II and III each with five tactiles; solenidia of tibiae II and III absent; claws II to IV simple, subequal in size; pulvilli II to IV well developed, longer than claws; coxa III elongate-triangular when viewed in inner ventral aspect; coxa IV similar in shape to coxa III but slightly larger; tarsus IV short, rather abruptly constricted basad of pretarsus; ratio of femurogenu IV to tarsus IV approximately 1 to 2.7.

DESCRIPTION OF GRAVID FEMALE (based only on *D. keiferi* Krantz). Gnathosoma and propodosoma as described for non-gravid female but entire hysterosoma becoming physogastric, globular; diameter of hysterosoma of slide-mounted specimens containing eggs, 245 to 400μ.

DESCRIPTION OF MALE (based only on *D. keiferi* Krantz). Length, approximately 105 to 115μ; width, approximately 60 to 65μ; hysterosoma ovate; conjunctival areas not granulose.

Gnathosoma. Subglobose, well developed, apparently functional, chelicerae indistinct but palp and internal pumplike structure at least partly distinct.

Propodosoma. Dorsum. Similar to that of female but much broader, bearing four pairs of setae in approximately same location to each other as in female. *Venter.* Similar to that of female.

Hysterosoma. Dorsum. Four visible dorsal segments, the first bearing two pairs of setae, the second one, the third two, the fourth three; fifth segment ventral. *Venter.* Posterior ventral plate similar to that of female but lacking median posterior lobe; hysterosomal venter apparently fused with segment V, the combined sclerites bearing four pairs of setae, acuminate posteriorly, aedeagus apparently opening at apex, aedeagal armature indistinct, perhaps lacking; well defined genital capsule or specialized clasping structures lacking; internal triangulate structure (vesicula seminalis?) prominent between aedeagal duct and vas deferens.

Legs. Unmodified, generally shorter but otherwise similar to those of female.

Habits. The only published information concerning the habits of *Dolichocybe* is found in the description of *D. keiferi.* Krantz (1957) states that the females give birth to active adult males and females. Gravid females were found under the bark of *Acer palmatum* Thunb. "at approximately the cambium." The limbs of the tree from which the type series was taken were dying but the relationship of the mites, if any, to this condition was not known. A series of gravid females taken from the "tunnel of a wood borer" have been seen by this author. They indicate a more probable parasitic method of existence. The form designated as *P. fusiformis* by Krczal is recorded by that author from *Scarabaeus sacer* L. and *Tatropium gabrieli.*

Because of the relatively unmodified posterior portions of the male body, it is probable that at least males of *D. keiferi* do not grasp and carry the females about prior to and during copulation as is the habit of the higher pyemotids.

DISTRIBUTION. *D. keiferi:* Known from Arizona, California, Washington, and Puerto Rico. "*D. fusiformis*" of Krczal: Known from Italy and France.

SPECIMENS EXAMINED. *D. keiferi,* from Arizona, Washington, California (Syntypes), and Puerto Rico, taken from the following hosts or situations: *Acer palmatum,* custard apple, from beneath apple bark, and in tunnel of wood borer in red bud.

Forms thought to belong to *Dolichocybe* Krantz:

keiferi, Krantz, 1957
Pavania fusiformis, Krczal, 1959, *not P. fusiformis* Lombardini, 1949

Pyemotes Amerling

(Figs. 21-24)

Heteropus Newport, 1850, Proc. Linnean Soc. London, 2:70 (*nom. praeocc.* in Insecta, Palisot-Beauvois, 1805). Type, *Heteropus ventricosus* Newport, 1850, by original designation.

Pyemotes Amerling, 1862, Česka Společnost Nauk, Prague, 1862, p. 54. Type, *Piemotes Eccoptogasteri pruni* Amerling, 1862, *nomen nudum* = *Heteropus ventricosus* Newport, 1850, by designation of Oudemans, 1937.

Lais DeFilippi, 1862, Archivio per la Zoologia, l'Anatomia e la Fisiologia, 1(2): 211-215, Tav. XIV (*nom. praeocc.* in Tunicata, Gistel, 1848). Type, *Lais heterogyne* DeFilippi, 1862, by original designation.

Physogaster Lichtenstein, 1868, Bulletin Entomologique. Seánces de la Société Entomologique de la France, (4)8: LXXXVI (*nom. praeocc.* in Insecta, Lacordaire, 1830). Type, *Physogaster larvarum* Lichtenstein, 1868, by original designation. *larvarum* = *nomen nudum* Oudemans, 1936.

Pediculoides Targioni-Tozzetti, 1878, Annali dell'Agricoltura, 1:241. Type, *Acarus tritici* LaGrèze-Fossot and Montané, 1851, Rec. Agronomique de la Société des Sciences, Agriculture, et Belles Lettres, 32(2), by original designation, *not Pediculoides tritici* Targioni-Tozzetti, 1878.

Crithoptes Geber, 1879, Wiener Medizinische Presse, 20(43): 1429. Type *Crithoptes monunguiculosis* Geber, 1879, by original designation.

Sphaerogyna Laboulbène and Megnin, 1885, Journal de l'Anatomie et de la Physiologie Normales et Pathologiques de l'Homme et des Animaux, 21:14. *Nom. nov. for Heteropus* Newport, 1850.

Physacarus Trybom, 1893, Entomologisk Tidskrift, 14: 121-126. *Nom. nov.* for *Heteropus* Newport, 1850.

Phthiroides Oudemans, 1936, Festschrift für Embrik Strand, 1: 403. Type, *Phthiroides megnini* Oudemans, 1936, *nom. nov.* for *Sphaerogyna ventricosa* (Newport) Laboulbène and Megnin, 1885, *not Heteropus ventricosus* Newport, 1850.

Members of this genus are among the best known of all Acarina. At least one species is a parasite of larval Lepidoptera in various stored grains, in which it may form large populations, these swarming to attack handlers and carriers of the infested material. The bite causes mild to severe cutaneous reactions, always accompanied by severe itching and sometimes by nausea and other symptoms. The erruption resulting from a number of bites has been confused with scabies, chicken pox, and other diseases. Severely infested grain has been reported fatal when fed to chickens (see Schamberg, 1910). This paper will not deal with the medically important aspects of *P. ventricosus* and related forms since they have been well reviewed by several authors. A nearly complete bibliography of the literature extant in this area is available from the author upon request.

Attempts to utilize a species of *Pyemotes* in the biological control of the boll weevil were unsuccessful (Hunter and Hinds, 1905).

Although the author follows Oudemans (1936), in placing at least four forms in the genus, it seems improbable that host specificity is as restricted as believed by that author. Lichtenstein [1868, (*in* Webster, 1883)], and Herfs (1926), recorded a *Pyemotes* attacking larval Hymenoptera, Coleoptera, and Lepidoptera indiscriminately, and the latter author deliberately cultured the parasite successfully on various hosts. (For detailed listings of hosts, see Herfs, 1926.) More recently Krczal (1959a), describes *P. boylei*, mentioning that it is an efficient parasite of both the anthribid *Araecerus levipennis* Jordan, and of the termite *Cryptotermes brevipennis* Walker.

Because of the medical importance of the genus numerous publications have appeared which are concerned with its bionomics. Probably the most notable are the works of Brucker (1901), Herfs (1926), Monterosso (1934), and Krczal (1959b). Pätau (1936), has made detailed cytogenetic studies of one species.

DIAGNOSIS. Females may be separated from all others in the family except *Trochometridium* because the posterior ventral plate is tripartite, its median section elongate and triangular. They are distinguished from *Trochometridium* in that coxa IV is triangular in the manner of coxa III, because the palps are fused to the gnathosoma, and by the presence of a pair of opisthosomal ventral setae.

DESCRIPTION OF NON-GRAVID FEMALE. Length, approximately 200 to 325μ; width, approximately 70 to 125μ; hysterosoma elongate, cylindrical to fusiform or rarely rhomboidal; body weakly to lightly sclerotized and without coarse punctae.

Gnathosoma. Subglobose to ovate, usually large, normally directed anteriorly; palps fixed, fused to gnathosoma; anterior margins of gnathosoma protruding slightly, truncate or gently rounded, anterior extremity of ventral margin marked by second palpal setae; chelicera stout, distinct, aciculate; esophageal pharyngeal pump prominent; dorsobasal "tentorium" ("*Chitinspangen*" of Krczal) also well defined.

Propodosoma. Dorsum. Trapezoidal to sagittate, lateral margin sinuate, anterior margin often projecting over gnathosoma, indistinct; foramen opening anteriorly, foraminal collar absent; posterior margin projecting slightly to distinctly over the anterior margin of first hysterosomal tergum; pseudostigmata present, located in middle third; three pairs of propodosomal setae, posterior pseudostigmatal pair at least twice as long as either of others; peritremes dorsal, divergent, their elliptical openings near laterobasal angles of gnathosoma; esophageal "finned" structures absent. *Venter.* Anterior ventral plate with four pairs of setae, (Oudemans, 1936, probably erroneously, describes *P. fortuitus* as having but two pairs) ventrites I and II each with two pairs; ventral externals I not forked; coxa I attached at a right angle to longitudinal axis of body or slightly obliquely; apodemes II straight or weakly arcuate, complete or incomplete medially, their mesal terminations never suddenly bending posteriorly; anterior median apodeme distinct, complete; posterior marginal apodemes absent or indistinct except laterally; distinct band of conjunctival pleats absent between propodosoma and hyterosoma.

Hysterosoma. Dorsum. First segment entire, its anterior margin slightly to distinctly hidden beneath hind margin of propodosoma; cuticular attachments of dorsoventral muscles distinct anterior to dorsal setae II and III; fourth segment bearing two pairs setae, partially enclosing apex of hysterosoma; fifth segment reduced, normally visible only ventrally, bearing a single pair of ventral setae and the apical vulva. *Venter.* Posterior ventral plate elongate, poorly defined anteriorly, tripartite, possessing a large, distinct, median, trigonal area; posterior ventral plate with five pairs of setae; first axillary on or slightly posterior to apodeme III, always mesad of coxa III, second axillary well mesad of anterior sternocoxal condyle IV; external presternal well behind and usually only slightly lateral to internal presternal; one pair of poststernals, these arising from medial trigonal sclerite approximately on line drawn between posterior margins of coxae IV; apodemes III and IV short, the former gently arcuate, the latter gently sigmoid, neither reaching trigonal area; median apodeme absent; opisthosoma with wide band of distinctly pleated conjunctiva dorsally between segments III and IV, ventrally between the opisthosomal venter and segment V; opisthosomal venter entire, bearing a single pair of setae.

Legs. Usually slender, moderately elongate; leg I about as long as and distinctly thicker than leg II, five segmented; tarsus I quadrate to subconical, never wider than femurogenu I; lateral sensory spot absent; claw I arising from a short, stout pedicel, often appearing sessile or nearly so; thumb prominent to absent; trochanter I with four setae, seta *c* long-setiform; trochanter II with three setae, femurogenu II with three; trochanter III with two setae, femurogenu III with three; tarsi II and III each with five to seven tactile setae, solenidium of II near middle of segment, solenidia of tibiae II and III present or absent; claws II to IV simple or with weak basal spur, subequal in size; pulvilli II to IV well developed, longer than claws, coxa III elongate-triangular when viewed in inner ventral aspect; coxa IV similar in shape to coxa III but shorter and stouter; tarsus IV short, not or slightly longer than tarsus III, constricted abruptly basad of pretarsus; ratio of femurogenu IV to tarsus IV, approximately 1:2.0 to 1:2.5.

DESCRIPTION OF GRAVID FEMALE. Externally as in non-gravid female but opisthosomal conjunctival bands unpleating to form turgid, milky globe which may reach 2 mm. in diameter; segments IV and V visible and adjacent at apex of globe.

DESCRIPTION OF MALE (based only on males of one species in collection of author plus description of *P. boylei* Krczal, 1959a). Length 190 to 200μ; width, approximately 100 to 120μ; hysterosoma ovate; conjunctival areas not granulose.

Gnathosoma. Rounded, well developed, functional; palpi fused to gnathosoma as in female; chelicerae reduced but distinct, needlelike; esophageal-pharyngeal pump well defined.

Propodosoma. Dorsum. Large, trapezoidal or with sides sinuate, bearing three or four pairs setae, if four then fourth pair tiny, slightly anterior to and well mesad of anteriormost of remaining setae. *Venter.* Similar to that of female but shorter.

Hysterosoma. Dorsum. Dorsal segmentation modified, first plate subcircular, bearing three pairs setae, second reaching genital capsule (*"Kopulationsapparat"* of Krczal, 1959b), bearing but a single pair; posteriormost portion of body constricted to form capsule, this concave posteriorly, bearing single short pair of dorsal setae.

Venter. Apodemes III, IV, and V well developed, posterior median apodeme absent; setation of posterior ventral plate similar to that of female; opisthosomal venter not visible as definitive sclerite; one or two pairs of setae ventrally on genital globe; genital capsule with one dorsal pair and one ventral pair of suckerlike structures; aedeagus tubular, well sclerotized.

Legs. All legs five-segmented; legs I and II similar to those of female but shorter; leg III distinctly longer than I, II, or IV, coxa IV subquadrate, trochanter IV distinctly arcuate, width uniform, apex rounded.

Habits. These mites were generally believed by early workers to feed upon stored grain and their true nature as parasites of grain-infesting insects was not suggested until 1883 (by Webster). The following information is taken largely from Herfs (1926), and Krczal (1959b), and deals with *P. herfsi* and *P. scolyti* respectively. All known members of the genus are external parasites of insects, usually killing the host species. Hosts are recorded from the following orders: Homoptera, Coleoptera, Lepidoptera, Diptera, and Hymenoptera. In nearly all cases, the hosts are attacked in their immature stages, but there are occasional records of the parasitization of adults [*Callidium variable* (Cerambycidae), *vide* Brucker (1901); *Isosoma* (= *Harmolita*) *tritici* (Fitch) (*Eurytomidae*), *vide* Webster (1910); *Tineola bisselliella* Hummel (Tineidae), *vide* Herfs (1926)] and of eggs [*Magicicada septendecim* L. (Cicadidae), *vide* Marlatt (1898); and *Fidia viticida* Walsh (Chrysomelidae) according to Webster (see Reuter, 1900)]. Certain larvae may be immune to attack. Herfs mentions that the mites in his cultures failed to successfully parasitize larvae of *Ephestia kuhniella* Zeller although they readily attacked and killed those of *Tineola bisselliella* and *Pectinophora* (= *Gelechia*) *gossypiella* (Saunders). A larval cerambycid and the larvae of "Ringelspinner" were likewise not parasitized. Herfs concludes that this immunity exists by reason of the depth or hardness of the cuticle. Still other larvae, *e. g.*, those of *Diloba caeruleocephala,* were attacked and killed without enabling the parasite to complete its development.

Both males and females pass through all immature stages while still within the enormously distended, globular opisthosoma of the mother mite, and are born as adults. Most males are born during the first half of the birth period and normally are present only in small numbers (three to five percent of the total number of offspring at 25° C.). They seldom leave the body of the mother and are parasitic upon it. At 25° C., males of *herfsi* removed from the maternal "opisthosomal globe" died 16 to 25 hours after removal, presumably from starvation, and if placed on the bodies of normal, healthy hosts did not feed. Males are usually found resting quietly on the opisthosoma of the mother, for the most part near the vulva, or (*P. scolyti*) the first born male may remain partially within the vagina of the mother, only the posterior portion of its body protruding through the vulva. They may (*herfsi*) or do not (*scolyti*) assist in the birth of the females by grasping the latter with the hind legs and pulling, shifting the grasp, pulling again, etc. This aid is not necessary since birth of the females continues smoothly in the absence of males although taking slightly longer (average birth time of females of *herfsi* with males, 171 seconds, average time without males, 217 seconds). In *scolyti* the combined processes of birth and mating require less than a minute.

As soon as (*herfsi*) or shortly before (*scolyti*) the newly born female completely leaves the birth canal, the male initiates copulation. In *herfsi,* he grasps the female and adjusts, with the assistance of the hind legs, her body until contact is made. This entire process of adjustment and mating may take 10 minutes or more, although actual copulation probably lasts only 20 to 30 seconds. Females of *scolyti* push past the intruded body of the male until they reach the level of the hind legs, at which point they are grasped and mated. Brucker (1901) observed copulation to take place on the host rather than on the opisthosoma of the mother. This may be a specific difference, since the material investigated by Brucker parasitized *Callidium* sp. (*Curculionidae*) while Herfs' forms were found on lepidopterous larvae. Because of the configuration and length of the hind legs in the male, Oudemans (1936) designates this first form *P. bruckeri, nom. nov.*

Males of *herfsi* normally assist only in the birth of the females, paying no attention to emerging males. They likewise ignore mated females, although one or more males may attempt to disrupt pairs *in copulo.* Early in the birth period of the mother, only a single *herfsi* male is usually found on the opisthosoma but as this period progresses, several may be present. The second and succeeding males of *scolyti* likewise take up parasitic residence upon the maternal hysterosoma. They seemingly function as replacements for the male situated partially within the vagina, and wait to assume its task of inseminating each female as she is born.

Shortly (within 10 minutes) after being mated, the young female leaves the body of the mother and seeks food. If, however, males are lacking on the maternal hysterosoma, young females do not leave but remain resting upon the latter for some time awaiting the birth of a male. Only after a full day or longer do they leave. Unmated females seemingly suffer a high mortality, only about 10 percent of those in experimental cultures surviving to produce offspring. Such females are arrhenotokous, producing only males. The total number of offspring produced compares favorably with that of mated females of the same size.

According to both Krczal and Herfs, young females die of starvation within 48 hours of their birth if food is not found. This statement makes dispersion and perhaps overwintering difficult to explain since it is obviously the young females which must disperse. Herfs found that young females unable to find a host would sometimes return to the mother and feed in the manner of the male on the parent's hysterosoma. Rarely this filial parasitism became permanent and ended with the death of the mother and the production of offspring by the daughter. More commonly it was quite transitory and resulted in no visible harm to the mother while seemingly providing the daughter with enough food to prevent at least immediate starvation.

Young females of both *herfsi* and *scolyti* are stimulated by moving objects soon after leaving the mother, stretching the body toward the source of the stimulus. Such behavior indicates dispersion by phoresy, a phenomenon which has been observed only rarely in *Pyemotes* despite its widespread occurrence in other members of the family. Krczal observed young females of *scolyti* attached to adult *Scolytus scolytus* to live somewhat longer than isolated females of the same age, from which he concluded that such phoretic females fed from body exudates of the host without obtaining enough nourishment to initiate physogastry.

In view of the fact that young females starve so quickly, the questions of their survival between generations of the host and of overwintering remain essentially unanswered. As mentioned by Krczal, perhaps the phoretic period is ephemeral, serving only to bring the females into fortuitous contact with one of a number of possible hosts. This could explain their rare and sporadic occurrence in the nests of solitary bees and social wasps, hosts in which an overwintering period would be required of the young females. Presumably, such a period would result in their migration or death, thus preserving the host from further attack until the next "accidental" infestation occurred.

Upon finding a host, the young female selects a favorable location and inserts her chelicerae, an action which may elicit striking or curling movements from the host. Within a short time, the host begins to show signs of paralysis, this increasing until the larva is completely incapable of movement. Time elapsed between onset of attack and complete paralysis depends upon the number of punctures made, but generally is two to four hours. The same larva may be attacked by several mites, Herfs having counted a maximum of 178 on a single host.

The parasite develops quickly, the opisthosoma increasing in both length and width until the mite assumes a form (the "Zitronenstadium" of Herfs) quite similar to an incandescent light bulb. This stage is usually reached in about 24 hours. Complete development, in which the opisthosoma becomes a huge, turgid sphere may be completed in another 24 hours, although it usually requires seven to eleven days to reach maximum size. At 25° C. the average time from initial insertion of the chelicerae to birth of the first offspring is 9.5 days in *P. herfsi*.

The size of the opisthosomal globe is well correlated with the number of offspring produced. In cases of multiple parasitism the size of the opisthosoma will be reduced, and females concerned will produce a relatively small number of offspring, sometimes averaging as low as six or seven. Females of *herfsi* reared singly produced a maximum of 284 offspring and averaged 128 at 25° C. and 150 "at room temperature." The birth period, usually terminated by the death of the female, ranged from 9 to 33 days and averaged 17.3 days. The average life span of the females in Herfs' cultures at 25° C. was 26.8 days as measured from the beginning of feeding to the death of the mite.

The average life span of the male is much shorter, since it dies with the mother mite. It was found that longevity of *herfsi* males was also positively correlated with amount of sexual activity. The temperature of the microhabitat was also an important factor affecting both longevity and fecundity of both sexes. Several previous workers have found 25 to 30° C. to be optimum and Herfs noted a loss in the ability of the mother to give birth at 35° C.

DISTRIBUTION. At least *P. ventricosus,* cosmopolitan.

SPECIMENS EXAMINED. At least two species (one near *scolyti,* one near *boylei*) from many parts of the United States from the following hosts or situations: scolytid beetle, nest of wasp, man, cotton crop residue, pink bollworm larvae, scale (?*Chrysomphalis*) on *Quercus macrocarpa Michx.*

Species thought to belong in *Pyemotes:*

alastoris (Froggatt, 1894) (*Heteropus*) *Nomen dubium*
anobii Krczal, 1959
attelabrinus (Debey, 1849) (*Dermaleichus*)
beckeri Krczal, 1959
boylei Krczal, 1959
bruckeri Oudemans, 1937
dryas (Vitzthum, 1923) (*Pediculoides*)
Eccoptogasteri pruni Amerling, 1862 (*Piemotes*) *Nomen nudum*
fortuitus (Oudemans, 1936) (*Pediculoides*)
hartigi Oudemans, 1937 *Nomen dubium*
herfsi (Oudemans, 1936) (*Pediculoides*)
heterogyne (DeFilippi, 1862) (*Lais*)
larvarum (Lichtenstein, 1868) (*Physogaster*) *Nomen nudum*
megnini (Oudemans, 1936) (*Phthiroides*)
monunguiculosus (Geber, 1879) (*Chrithoptes*)
schwerdtfegeri Krczal, 1959
scolyti (Oudemans, 1936) (*Pediculoides*)
takeuchii (Sasa, 1947) (*Pediculoides*)
tritici (LaGreze-Fossot and Montané, 1851) (*Acarus*)
ventricosus (Newport, 1850) (*Heteropus*)

Siteroptes Amerling

As defined herein, this genus includes several forms placed by various authors in *Pygmephorus* and other genera. Although including a series of forms which range from a relatively primitive *Dolichocybe*-like species to forms very closely related and ancestral to the mites of the subfamily Pygmephorinae, the author has preferred to include them in a single genus divided into three subgenera. In addition to these, the author has seen a single damaged specimen of an undescribed species which is obviously quite closely related to primitive forms of *Pediculaster,* and which, when described, should undoubtedly form a fourth subgenus.

A relatively large number of forms seemingly occur in North America. Fifteen species are thought to be included in the material, nearly entirely North American, studied during the course of this work.

Most species are thought to be phytophagous or saprophagous. Only S. *aradii* Krczal is known to be phoretic upon insects.

DIAGNOSIS. The females of this genus may be distinguished from those of all other genera in the family by the following combination of characters: leg I with five segments; single claw of tarsus I simple, pedicellate, lacking thumb; chelicerae small, indistinct; palps free.

DESCRIPTION OF NON-GRAVID FEMALE. Length, approximately 155 to 390μ; width, approximately 75 to 175μ; hysterosoma elongate-cylindrical to broadly elliptical; body usually weakly, occasionally moderately sclerotized, and without coarse punctae.

Gnathosoma. Squarish to elliptical, normally directed anteriorly; palp distinct, free, short to moderate in length, its apex usually dentate, one tooth usually much longer than the rest; chelicera tiny, indistinct; esophageal-pharyngeal pump absent; esophagus straight, thick, usually indistinct.

Propodosoma. Dorsum. Soft, shape variable according to mount but generally elongate-trapezoidal or elongate with sides broadly sinuate, expanding laterally at points of articulation of legs I and II, anterior margin forming cervix which encloses base of gnathosoma, this cervix continuing around gnathosoma to form indistinct foraminal collar which may or may not become excavated on ventral surface; posterior margin meeting or barely covered by first hysterosomal segment; pseudostigmata present, arising in posterior one-half; three pairs of propodosomal setae, posterior pseudostigmatals always distinctly longer than other two pairs; peritremes dorsal and anterior, or arising anteromesally near stigmatal setae, elongate-cylindrical to guttate or (rarely) circular; esophageal "finned" structures present, indistinct or distinct, usually one short structure in gnathosoma or propodosoma followed by a more or less globular or quadrate structure, this followed by a third structure which may be similar to the preceding one or by a shorter structure whose posterior margin is distinctly defined and recurved cephalad. *Venter.* Anterior ventral plate with four (rarely) to six pairs setae, ventrites I usually with three pairs; external ventrals I forked or not; coxa I attached at a right angle to longitudinal axis of body; apodemes II distinct, weakly sigmoid, usually incomplete medially, always bending posteriorly as they approach anterior median apodeme; anterior median apodeme distinct, complete, posterior marginal apodemes well developed only laterally; large band of pleated conjunctiva indistinct or absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment entire, meeting or extending slightly over posterior margin of propodosomal dorsum; third and fourth segments with one or two pairs setae; fifth segment usually overlapped by fourth segment, enclosing apex of hysterosoma, bearing three pairs of setae; vulva apical, usually distinct, vagina enclosed apically by sclerotized, U-shaped, globose to elliptical pumplike enlargement or vaginal wall merely sclerotized apically; anterior and median genital sclerites absent; posterior genital sclerites usually also absent; a globose or omega-shaped vaginal structure sometimes distinct. *Venter.* Posterior ventral plate poorly defined anteriorly, entire or divided behind coxae III into two parts (fig. 19), the margins of these parts not corresponding to the ventral apodemes (epimera of authors), which are separately distinct; posterior ventral plate with four (rarely) to six pairs of setae, hind margin of posterior ventral plate trilobed, with single median lobe, or entire; external presternals well posterior to and directly behind or only slightly laterad of internal presternals; external poststernals rarely absent, if present distance behind coxae IV variable; apodemes III variable, present only laterally or complete, joining posterior median apodeme with anterior sternocoxal condyle of III; apodemes IV variable, distinct only laterally, or complete or nearly so, always joining anterior sternocoxal condyles of legs IV; apodemes V present or absent; posterior median apodeme variable, distinct only in region of apodemes IV, or well developed; opisthosoma (dorsally between terga III and IV, ventrally between the opisthosomal venter and segment V) with or without a wide band of distinctly pleated conjunctiva; opisthosomal venter entire, devoid of setae except in some *Metasiteroptes.*

Legs. Variable in length and thickness; leg I at least slightly thicker than leg II, five segmented; tarsus I quadrate, rectangulate, or elliptical, never wider than femurogenu I; lateral sensory spot absent; claw I single, simple, hooklike, moderately developed, distinctly pedicellate, pedicel stalklike, short, but usually distinctly longer than wide; thumb absent; trochanter I with three (rarely) or four setae, seta *c* long, setiform; trochanter II with three setae, femurogenu II with one to three; trochanter III with one or two setae, femurogenu III with one or two; tarsi II and III each with six (rarely) or seven tactiles; solenidium of tarsus II in proximal half; sensory pegs of tibiae II and III present; claws II to IV simple, subequal in size; pulvilli II to IV variable; coxa III elongate-triangular to elongate subcordate in inner ventral aspect; coxa IV triangular and smaller than coxa III (*Metasiteroptes*), quadrate, or short-rectangulate, usually widest at base; femurogenu IV with one seta or none; tarsus IV usually short and abruptly constricted basad of pretarsus; ratio of femurogenu IV to tarsus IV 1:2.1 to 1:6.2 (only rarely over 3.8—if as large as 6.2 then mite very large, 385μ long and having trochanter I with only three setae).

DESCRIPTION OF GRAVID FEMALE. Gnathosoma and propodosoma as described for non-gravid female, but entire hysterosoma becoming physogastric, globular. Diameter of hysterosoma of females as great as three millimeters.

DESCRIPTION OF MALE (based on three species of *Siteroptes s. str.* and *Siteroptoides*). Length, 120 to 165µ; width, 70 to 95µ; hysterosoma generally ovate, sharply constricted in vicinity of legs IV, opisthosoma forming enlarged connate, globose, or subtriangular copulatory structure; conjunctival areas not granulose.

Gnathosoma. Vestigal, present only as reduced lobe of varying shapes, this lobe bearing one median dorsal pair, one anterodorsal pair, and one posteroventral pair of tactile setae, in addition to two anteroventral pairs of solenidia.

Propodosoma. Dorsum. Much broader than that of female, bearing four pairs of setae. *Venter.* Similar to that of female but shorter and broader; with either five or six pairs of ventral setae.

Hysterosoma. Dorsum. Segmentation modified, first plate large, usually rounded posteriorly, bearing three pairs of setae; second plate much smaller, strongly or weakly defined, variable in shape, bearing one or two pairs of setae; third plate forming basal portion of genital capsule, with two pairs of setae, both pairs usually sensory, the anterior pair much the larger; aedeagal capsule large, attenuate apically, bearing two pairs of apicoventral setae; aedeagal armature well sclerotized, divided longitudinally into halves, pointed apically, short, aedeagal base not greatly elongate, not plainly recurved; internal "vesicula seminalis" usually globular, possessing lateral "wings." *Venter.* Apodemes IV and V well developed, apodemes III strongly developed entirely or only laterally; posterior median apodeme present, connecting apodemes V with apodemes IV or often ending anteriorly to join apodemes III; anterior extremities of apodemes V joining posterior median apodeme, characteristically obfurcate between coxae IV; setation of posterior ventral plate as described for female; hind margin of posterior ventral plate well posterior to coxae IV, enclosing genital capsule; opisthosomal venter apparently fused with genital capsule, not distinct.

Legs. All legs five-segmented; length, claws, setation, and proportions of legs I-III similar to those of female; leg IV tonglike, modified for clasping, short; coxa IV subquadrate, trochanter IV not distinctly arcuate, tarsus IV greatly reduced, two claws present but at least one greatly deformed, scooplike or irregular.

Key to the Subgenera of *Siteroptes* (Females)

1(*a*). Coxa IV triangular; posterior ventral plate divided and appearing as two distinct plates, each bearing a pair of legs *Metasiteroptes*, new subgenus, p. 105

1(*b*). Coxa IV quadrate or rectangulate; posterior ventral plate entire....2

2(*a*). Peritremes guttate, circular or rarely elongate-guttate, usually not much longer than wide, separated by less than one of their lengths; femurogenu II with three setae; apodemes V always well developed; ventrites II each with two or three setae *Siteroptoides*, new subgenus, p. 113

2(*b*). Peritremes usually elongate, at least twice as long as wide, or if circular or short-guttate, then separated by at least one of their own lengths; femurogenu II with two or three setae; apodemes V rarely well developed; ventrites II each with two setae...*Siteroptes sensu stricto*, p. 108

Metasiteroptes, new subgenus

(Figs. 19-20)

Type, *Siteroptes* (*Metasiteroptes*) *macer*, new species.

This subgenus is established to accommodate two species which retain several of the more primitive characters found in *Dolichocybe, etc.* including short, oblique, incomplete apodemes III, and triangular coxae IV. They are easily distinguished from all other known species of *Siteroptes* and perhaps deserve generic status.

DIAGNOSIS. For females, see the key characters. Males and immatures are unknown.

DESCRIPTION OF NON-GRAVID FEMALE (based upon S. *macer*). Hysterosoma elongate-cylindrical; body weakly sclerotized.

Propodosoma. Dorsum. Peritremes guttate, separated by much less than one of their lengths, only slightly diverging anteriorly; esophageal "finned" structures indistinct. *Venter.* Anterior ventral plate with five pairs of setae, ventrites II with two pairs; external ventrals I not forked.

Hysterosoma. Dorsum. First segment meeting posterior margin of propodosoma, fourth tergum with but a single pair of setae. *Venter.* Posterior ventral plate bipartite, divided transversely between hind margins of third coxae, each plate thus bearing one pair of legs; posterior ventral plate with five pairs of setae, one pair of poststernals lacking; posterior margin of posterior ventral plate with median lobe; apodemes III distinct only laterally; apodemes IV arcuate, weak but complete, arising laterally from anterior sternocoxal condyles of coxae IV; apodemes V absent; posterior median apodeme present only on hind portion of posterior ventral plate, its anterior extremity meeting apodemes IV; extent of pleated conjunctival bands not ascertainable because specimens are gravid.

Legs. Short; leg I much thicker than leg II; tarsus I quadrate-tapering; trochanter I with four setae; femurogenu II with one seta, femurogenu III with one; tarsi II and III each with six tactiles; solenidium of tarsus II near basal margin; pulvilli II to IV flaplike, longer than claws; claws II to IV stout; coxa III elongate-triangular in inner ventral aspect; coxa IV triangular, shorter than coxa III; femurogenu IV with one seta; tarsus IV resembling tarsus III in size and shape; ratio of femurogenu IV to tarsus IV approximately 1:2.7.

DESCRIPTION OF GRAVID FEMALE. As described above except that body becomes physogastric. Although the type females of S. *macer* are gravid, it is difficult to ascertain whether physogastry involves the entire hysterosoma or whether it is of the type found in *Pyemotes* in which only the opisthosoma becomes enlarged.

HABITS. Since gravid females were taken from the stems of sugarcane, it is possible that these mites are fungivorous in the manner of *Siteroptes sensu stricto.* Sporelike artifacts were found clinging to the bodies of both specimens of S. *macer.* The specimens of *aradii,* found upon the bodies of *Aradus depressus,* are the only forms known in the genus to practice phoresy.

Species thought to belong in *Metasiteroptes:*

?*aradii* (Krczal, 1959) (*Pyemotes*)
macer, n. sp.

Siteroptes (*Metasiteroptes*) *macer,* new species

DIAGNOSIS. Separable from *aradii* (Krczal) in being more slender, in the size and location of the dorsal setae of all segments, in the setation (and character?) of the posterior ventral plate, and in various other characters.

DESCRIPTION OF GRAVID FEMALE. (Only gravid females are known.) Distance between anterior sternocoxal condyles of coxae III, 43μ (44).

Gnathosoma. Elliptical, length, 20μ; width, 16μ; external dorsals absent; solenidia I indistinct, solenidia II elongate, weakly clavate; first palpal setae well anterior.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets 25μ (24); peritremes guttate, only slightly divergent, 0.4μ (0.4) apart; propodosomal setae stout, aciculate, indistinctly spiculate; stigmatal setae about one and one-quarter times as long as, anterior pseudostigmatals subequal to, and posterior pseudostigmatals about two and one-quarter times as long as pseudostigmata. *Venter.* All setae aciculate, nude, short, all those of ventrites I and internal ventrals II approximately 7-10μ; extenral ventrals II about 15μ long, distinctly behind internal sternals II and closer to coxa II than to them.

Hysterosoma. Dorsum. All dorsal setae aciculate, indistinctly spiculate; dorsals I stout, 40μ long (44), well posterior to laterals I, latter about 42μ (37) long, arising from posterior one-fifth of segment; dorsals II as stout and long as laterals I, arising directly posterior to dorsals I; dorsals III barely median of dorsals II and as stout and long, laterals III above and laterad of these, arising from middle of the segment, approximately 14μ long; dorsals IV directly behind dorsals I and II, about as stout and long as former, laterals IV absent; segment V with only two pairs of apicoventral setae, external pair as stout as setae of IV but shorter, about 29μ (31), internal pair about three-fifths of distance between external pair and longitudinal median line, short, 4μ (6). *Venter.* Posterior ventral plate elongate, distance from its anterior margin to anterior condyles of coxae III greater than length of coxae III; posterior margin of coxae III separated by approximately 10μ from anterior margin of coxae IV; posterior ventral plate divided into a posterior and an anterior portion separated by conjunctival area, each portion bearing a pair of legs; hind margin of anterior portion rounded, meeting anterior inner margins of coxae III laterally, this portion bearing internal and external presternals and first axillary setae as well as apodemes III; hind margin of posterior portion of plate with median lobe, this portion bearing one pair of poststernals, the second axillary setae, and apodemes IV; apodemes III developed only laterally, longitudinal median suture lacking between them, apodemes IV joining medially, forming a broadly inverted U, their point of fusion marking anterior extent of median longitudinal suture which extends posteriorly to posterior margins of coxae IV; first and second axillaries arising from their respective apodemes; one pair of poststernals, these approximately 3μ behind posterior margins of coxae IV, about as close together as internal presternals; all ventral setae short, smooth and aciculate, either about 0.25 or 0.70 times length of pseudostigmata.

Legs (all measurements in μ). *Length.* Leg I, 56; Leg II, 51; leg III, 55 (59); leg IV, 62 (63). *Width.* Leg I, 12 (13); leg II, 10 (11); leg III, 10 (10); leg IV, 9 (11). *Segment lengths.* tr I, 22 (24); ti I, 13; ta I, 12; ta II, 17; ti III, 9 (11); cx IV, 24; tr IV, 24 (23); fege IV, 8 (7); ta IV, 19 (20). *Setation.* Leg I: cx 1T, tr 4T, fege 3T, ti 6T + 2S, ta 6T + 7S; leg II: cx 1T, tr 3T, fege 1T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T, ta 6T.

Tarsus I distinctly thinner than tibia I; solenidium 1 of tibia I stoutly pedicellate, 6.5μ long; solenidium of tarsus II small (0.3μ), clavate; coxa III long-triangular, length 24μ (26), width 1μ (1), coxa IV also triangular, shorter, length 21μ, width 1μ (1).

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Holotype and one paratype, both gravid females, Barbados, British West Indies (intercepted in quarantine at New York, April 2, 1939, Post, collector), on stem of sugarcane, U. S. National Museum Lot Number 39-5651.

TYPE REPOSITORIES. Holotype and one paratype in the U. S. National Museum.

Subgenus *Siteroptes, sensu stricto*

(Figs. 10-12, 25-28)

Siteroptes Amerling, 1861, Lotos, XI: 26, *sine typo.* Type, *Siteroptes cerealium* Kirchner, 1864, Lotos, XIV:126, by subsequent designation, Kirchner, 1864.

Thermismoptes Amerling, 1861, Lotos, XI: 26, *sine typo.* Type, *T. cerealium,* Kirchner, 1864, Lotos, XIV: 125, by subsequent designation, Kirchner, 1864.

Pediculopsis Reuter, 1907, Festschrift für Palmen, 7: 3, Helsingfors. Type, *Pediculoides graminum* Reuter, 1900, by original designation.

Type: *Siteroptes cerealium* Kirchner, 1864, by subsequent designation, Kirchner, 1864.

This genus contained only the species *cerealium* Kirchner, 1864 (= *P. graminum* Reuter, 1900) until 1957, at which time Krantz described S. *reniformis.* The author has at least five additional undescribed species. Members of this subgenus are considered to be more specialized than those of *Metasiteroptes* in that coxa IV differs in shape from coxa III and the posterior ventral plate is entire. Many members of the group have lost at least one pair of setae on the posterior ventral plate, a loss often correlated with the loss of the third laterals. Apodemes III are usually distinct only laterally and are incomplete, apodemes IV are weak, incomplete or complete but always present near the midline. Apodemes V are only rarely present. Ventrites II always bear two pairs of setae.

The peritremes are only rarely guttate and if so, then are widely spaced; they usually diverge less than 90 degrees. Members of this subgenus are considered to be less specialized than those of the following subgenus although intergrades between the two groups occur.

DESCRIPTION OF NON-GRAVID FEMALE. Agrees with the description of the genus except for the following: length, 160 to 265μ; width, 75 to 130μ.

Propodosoma. Dorsum. Peritremes usually large, elongate-guttate or elongate-cylindrical, or if rarely circular or short-guttate then separated by at least one (usually more) of their own lengths, their axes usually not diverging more than 90 degrees. *Venter.* Anterior ventral plate with five pairs of setae; ventrites II always with two pairs.

Hysterosoma. Third tergum often with only a single pair of setae, the laterals absent. *Venter.* Posterior ventral plate entire; apodemes III incomplete medially, usually not extending mesally beyond internal presternals; apodemes IV weak, complete or incomplete, always distinct along midline and laterally in front of coxae IV; apodemes V usually absent; posterior median apodeme weak or absent anterior to its union with apodemes IV.

Legs. Trochanter I with four setae; femurogenu II with one to three (usually two) setae; tarsi II and III each with seven tactiles.

Species thought to belong in *Siteroptes s. str.*:

antiquissimus (Krczal, 1959) (*Pygmephorus*)
avenae (Müller, 1905) (*Pediculoides*)
cerealium Kirchner, 1864
dianthophilus (Wolcott, 1908) (*Pediculoides*)
graminum (Reuter, 1900) (*Pediculoides*)
primitivus (Krczal, 1959) (*Pygmephorus*)
reniformis Krantz, 1957

HABITS. *Siteroptes cerealium*[4] is important as a principal vector of *Fusarium poae* (Peck) (Deuteromycetes), the pathogen of a disease variously known on a number of meadow grasses as "silvertop," Weissährigkeit, or Bollnäserkrankheit, and on carnations as "central bud rot" (Cooper, 1940). In addition, it has recently (Alfaro, 1946) been implicated in the transmission of *Nigrospora oryzae* (Berk. & Br.), a fungal parasite of grains.

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[4] A discrepancy in the number of chromosomes found by Reuter (1909b) and Cooper (1937) was found to exist. Cooper (1939) states, after examination of some of Reuter's slides, that the latter author was in error, the correct diploid chromosome number being six.

The most important works dealing with the bionomics, genetics, morphology, and embryology of this species are those of Alfaro (1946), Bradbury (1926), Cooper (1937, 1939, 1940), Molz and Morgenthaler (1912), Reuter (1900, 1907, 1909), Stewart and Hodgkiss (1908), Weiss (1915), and Wolcott (1908).

The following account of the life history of S. *cerealium* is taken largely from Reuter (1900 and 1909a), and Cooper (1937, 1940).

Apparently, only the young mated females of this species disperse. These females readily leave their place of birth and seek food and shelter. They are capable of traversing tight places and are able to escape from and enter vials tightly stoppered with cotton plugs. Those attacking grasses commonly take up residence between an upper (usually the uppermost) leaf sheath and the culm; those attacking carnations force their way into the buds where they are found near the inner floral organs. Once so located, the young female begins to feed, this feeding being prerequisite to physogastry. The exact nature of the food is not known. All authors agree that tissue necrotized through the invasion of *F. poae* is ingested. Alfaro (1946) and Reuter (1900) state, in addition, that the mites are capable of attaining physogastry after feeding upon healthy tissue. Cooper (1940) doubts this to be the case, finding physogastric females to be associated only with diseased plants in every instance. The same author found that the mites will feed and readily subsist upon the mycelium of *F. poae* isolated in agar plates.

The duration of the feeding period before the onset of physogastry is not clear but Cooper (1940) mentions one case in which noticeable swelling occurred six days after the females were placed on the soil near carnations in a greenhouse. How much, if any, of this period was spent in waiting for the plant tissue to become suitably decomposed by the fungus is unknown.

Females become increasingly less mobile as physogastry progresses and finally become totally incapable of movement, remaining anchored by palps and (probably) by at least one pair of front legs until they die. The volume of these females may be increased to 100 to 500 times that of non-gravid forms, and their width may measure 3000μ. Like those of many other genera and unlike those of *Pyemotes,* the entire hysterosoma swells, balloonlike, while the propodosoma remains unmodified. Within this fluid-filled hysterosomal globe, the eggs develop and hatch into active hexapod larvae. In most instances, these remain within the maternal body, where they supposedly quickly molt to the octapod nymph. According to Reuter (1900), these latter are distinguishable as to sex and differ from the adult only in the development of the organs of reproduction. The appearance of this stage is an anomaly seemingly restricted to members of this genus, or perhaps to *cerealium*. I have seen males and larvae of several species but no nymphs. Perhaps later research will prove Reuter's nymphs to have been merely teneral adults. The species differs from previously discussed members of the Pyemotinae and from known Acarophenacinae and resembles most Pygmephorinae in having at least one definitive immature stage.

According to Reuter, larvae and nymphs (especially the latter) are often born and move freely about the host plants where they soon settle and molt to the ensuing stages. Cooper (1937) states that this is rarely the case and that usually only adult mites are born.

The above author gives the time of development from egg to nymph as four to five weeks but makes no mention of the temperatures at which this rate of development occurred. Both he and Alfaro state that two or three generations occur in a season.

Although Reuter thought that mating takes place on the host plant, Cooper (1937) found that laboratory-reared mites usually mate in the adult stage while still within the body of the mother but noted that in rare instances mating took place while adults were still upon the surface of the maternal hysterosoma. Copulation was observed to last between 5 and 35 seconds.

The mass birth of the offspring is attended by the hysterosomal breakdown and accompanying death of the mother.

Cooper (1937) counted the offspring obtained from three series of females. The first series contained 17 female parents and totalled 1643 offspring (mean, 96.5/female), the second 72 females and 11,446 offspring (mean, 158.8 offspring/female), and the third 30 females and 4385 offspring (mean, 146.0/female). No information as to the circumstances surrounding the procurement of these three samples or reasons for the large differences in mean fecundity between them are given. The same author found males to occur in every brood, although in small numbers. The three samples mentioned above produced 4.50, 4.46, and 5.15 percent males respectively. Reuter (1900) found no males in the spring but a progressive increase in their numbers during the summer until a high of about 13 percent males was reached in the fall. This increase was thought to coincide with the need for relatively large numbers of mated overwintering female nymphs and the absence of males in the spring was attributed to the fact that they do not overwinter. On the basis of the findings made in related genera, it is most probable that a relatively constant number of males is produced in every generation, as inferred by Cooper. Similar evidence suggests that mated females, rather than nymphs, are the overwintering forms.

The above two authors concur in recording high mortality invariably occurring in unmated females. Cooper noted only two cases in which such females became physogastric. Both were arrhenotokous. It is interesting to note that the mean number of offspring per female (306) in these two cases was considerably higher than in mated females. Perhaps this discrepancy may be explained by the relatively smaller size of the male.

Gravid females may be found in gradually increasing numbers until October. These produce large numbers of forms which (see above) Reuter believed to be overwintering female nymphs. According to that author, such nymphs may be virgin or may be mated immediately after birth. The former usually die the ensuing spring without molting to adulthood.

Cooper (1940) has demonstrated the ability of S. *cerealium* to transmit the spores of *F. poae* to carnation, and Alfaro (1946) has experimentally transmitted the fungus *Nigrospora oryzae* by means of the same mite. The present author has sometimes seen elliptical or circular sporelike objects upon or within the bodies of *Siteroptes* females.

The relationship between the fungus and the mite is stated to be a symbiosis in which the mite disseminates and innoculates the fungus which alters the plant tissue to provide (more suitable) food for the mite. Cooper points out that this symbiosis is antagonistic in that the mite may feed upon the fungus.

The phenomenon investigated and named *Karyomerokinesis* by Reuter (1909b) is reinvestigated in detail by Cooper (1939). Aside from a unique elaboration of Feulgen-negative chromosomelike material between separating chromosomes, mitosis in the early cleavage divisions of the egg is similar to that found by Pätau (1936) for *Pyemotes ventricosus*. Karyomery and the formation of equatorial bodies ceases by the tenth cleavage division. Karyomeres disappear in the prophase, reappearing as vesicles in the telophase.

Specimens examined. Nine species, including *reniformis* and probably *cerealium* and *primitivus*, from many parts of the United States and from France, from the following situations or hosts: Salt marsh grass (*Distichlis* sp.), grass, *Celtis occidentalis* L., carnations, cotton bolls (syntypes of *reniformis*), milo maize, *Setaria* sp., nest of *Microtus* sp., treehole in *Fagus grandifolia* Ehrh., peach orchard soil, decaying log, forest floor litter.

Siteroptoides, new subgenus

(Figs. 51-53)

Type, *Siteroptes* (*Siteroptoides*) *absidatus*, new species.

This new subgenus contains at least six species. Although its forms intergrade with those of *Siteroptes s. str.*, it is considered to be more specialized than the latter and perhaps more closely related to *Pediculaster* and the Pygmephorinae, as evidenced by the development of the apodemes of the posterior ventral plate, by the location, proximity, and amount of divergence of the peritremes, and by the additional pair of setae of the second ventrites.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 150 to 320µ width, 80 to 160µ; hysterosoma elliptical.

Propodosoma. Dorsum. Peritremes guttate or elongate-guttate, occasionally septate, usually diverging at least ninety degrees, separated at their bases by less than one of their widths. *Venter.* Anterior ventral plate with five (rarely) or six pairs of setae, when six then ventrites II with three pairs.

Hysterosoma. Dorsum. Third and fourth terga usually with two pairs of setae, laterals rarely reduced or absent. *Venter.* Posterior ventral plate entire, usually bearing six pairs of setae, or (rarely) internal poststernals absent; external poststernals always well behind posterior margin of coxae IV; apodemes III always well developed, complete or nearly so, bending posteriorly at the sides to join anterior sternocoxal articulation of III, bending posteriorly in the middle to join posterior median apodeme; apodemes IV complete (sometimes distinctly weakened near posterior median apodeme), usually indistinctly forked laterally, one branch bending posteriorly to join anterior sternocoxal articulation IV, the second branch meeting and continuing posteriorly and dorsally around the margin of coxal foramen III; apodemes V well developed, joining the posterior extremity of the posterior median apodeme; posterior median apodeme always well developed anterior to apodemes IV, meeting apodemes III.

Legs. Trochanter I with four setae; femurogenu II always with three tactiles; tarsi II and III each with seven tactiles.

Species thought to belong in *Siteroptes* (*Siteroptoides*):

absidatus, n. sp.
priscus (Krczal, 1959) (*Pygmephorus*)

HABITS. Nothing is known of the habits of this group. Those in the author's collection were collected in a variety of habitats—on plants, in soil, in a treehole, and in cattle manure in a rearing cage of *Siphona irritans.* One specimen (from Soledad, Cuba) has a single sporelike structure attached to it.

SPECIMENS EXAMINED. In addition to the type series of *absidatus* probably six species from many parts of the United States and from Cuba, Haiti, and Holland, from the following situations or hosts: treehole in *Fagus grandifolia,* stems of *Paeonia* sp., corm of *Gladiolus* sp., oats, and on cattle droppings in cage of *Siphona irritans* L. (Diptera).

The specific status of some of the specimens is not clear. Including *absidatus,* the author has three forms which are closely related and which may be conspecific, differing in size, shape, and location of the solenidia of tibia and tarsus I as well as in minor features of the placement and size of the setae of terga III, IV, and V. In view of the small number of specimens at hand, obviating any possibility of ascertaining intergradation, if present, it has been considered best to restrict the definition of *absidatus* to the three specimens described.

Siteroptes (*Siteroptoides*) *absidatus,* new species

DIAGNOSIS. Differs from *priscus* (Krczal) in the shape of solenidia 3 and 4 of tarsus I, in that the peritremes are more widely spaced, in that external caudals II are much longer than the other two pairs, and in various other characteristics.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 265μ (150-265); width, 132μ (80-132); distance between anterior sternocoxal condyles of coxae III, 74μ (55-74).

Gnathosoma. Quadrate, approximately 30 x 30μ; external dorsals arising well laterad of and slightly behind internal dorsals, aciculate; solenidia I distinct, appearing concave apically, solenidia II elongate, clavate; distance between first and second palpal setae about 7μ; esophagus with small, slightly thickened mesal dilation.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets 29μ (22-30); peritremes guttate, greatly divergent, their long axes making an angle of about 130 degrees, their most mesal margins 4µ (2-4) apart; propodosomal setae stout, aciculate, spiculate, the stigmatals 29µ (17-29), the anterior pseudostigmatals only slightly shorter, the posterior pseudostigmatals comparatively short, 40µ (29-42), arising slightly behind internal pseudostigmatal sockets and on longitudinal line drawn through their mesal margins. *Venter.* Six pairs setae, ventrites I and II each with three pairs; setae of anterior ventral plate aciculate, nude, short, range 11 to 20µ, median ventrals I closer to anterior median apodeme than median ventrals II, external ventrals I not forked, arising posterior to internal ventrals I; ventrals II subequally spaced and sublinearly arranged.

Hysterosoma. Dorsum. All dorsal setae stout, aciculate, sparsely spiculate; setae of segment I in a transverse row, dorsals I 29µ (18-30), 40µ (30-42) apart, laterals I 41µ (26-45), distinctly closer to respective dorsals than dorsals to each other; dorsals II 34µ (24-39) long, 50µ (39-53) apart; dorsals III as laterals I, 46µ (33-52) apart; laterals III 19µ (9-19) arising posterolaterad (not more than 20µ laterad) of dorsals; dorsals IV as laterals I, 32µ (20-33) apart, laterals IV 19µ (15-22) long, distinctly farther from their dorsals than those of third tergum; external caudals II 7-22µ long, distinctly longer than other two pairs; apical portion of vagina with distinct sclerotized thickening that is globular to elliptical in shape. *Venter.* Hind margin of posterior ventral plate broadly and shallowly emarginate; apodemes III mesad of internal presternals and posterior median apodeme between apodemes III and IV weakly developed; internal presternals arising from apodemes III, external presternals arising about two areolar diameters anterior to apodemes IV, directly behind internal presternals; internal poststernals present, distinctly mesad of external presternals, external poststernals arising behind posterior terminations of apodemes V, laterad of external presternals; second axillaries immediately mesad of apodemes IV, slightly anterior to internal poststernals; all setae of posterior ventral plate flagellate, nude, similar in shape, short (7-18µ), longest on any one specimen never twice length of the shortest.

Legs (all measurements in µ). *Length.* Leg I, 90 (65-94); leg II, 72 (52-77); leg III, 72 (51-80); leg IV, 105 (69-110). *Width.* Leg I, 17 (13-18); leg II, 13 (9-13); leg III, 11 (8-12); leg IV, 11 (8-12). *Segment lengths.* tr I, 33 (24-36); ti I, 20 (14-22); ta I, 25 (16-25); ta II, 24 (16-25); ti III, 13 (8-14); cx IV, 30 (19-34);

tr IV, 26 (17-28); fege IV, 8 (6-9); ta IV, 32 (19-33). *Setation.* Leg I: cx 1T, tr 4T, fege 4T, ti 6T + 2S, ta 15 (T and S not separable in most instances): leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 7T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 7T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Tarsus I with only two clavate or cylindrical solenidia, the rest setalike; solenidium 3 rodlike, curved, slightly longer than claw, arising at level of pedicelar base; solenidium 4 rodlike, straight, less than half as long or wide as 3, arising behind 3 but in apical third of segment; solenidium of tarsus II thickly rodlike, elongate, basal; solenidia of tibiae II and III small, clavate, arising at basal quarter of segment; tarsi II to IV constricted suddenly near most apical setae; coxa IV wider at base than at apex; solenidium of tibia IV small, weakly clavate, arising at basal quarter of segment; pulvilli II to IV shorter than respective claws; ratio of femurogenu IV to tarsus IV, approximately 1:3.1 to 1:4.0.

VARIATION. Little variation in setal placement, size, etc. is found in the type series. A great range in size exists, however, as is indicated by the presence of one very small specimen. The measurements of this specimen are available from the description since they are the smallest measurements in every case.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and two female paratypes (none gravid) from Howard County, Arkansas, June 8, 1936, W. F. Turner, collector. U. S. N. M. Lot Number 36-20984.

TYPE REPOSITORIES. Holotype and paratype No. 2 to the United States National Museum. Paratype No. 1 to the Snow Entomological Museum, The University of Kansas.

Trochometridium, new genus

(Figs. 29-40)

Type, *Trochometridium tribulatum,* new species.

This genus is erected to accommodate a single new species, which while showing affinities to both *Siteroptes* and *Pyemotes,* is very distinct from either. It resembles the former and differs from the latter in having a squarish gnathosoma bearing free palpi and dorsal, approximate stigmata, in that coxae IV are quadrate (although distinctly dicondylic), in the structural conformation of the gravid female, in that mass laying of eggs (accompanied by hysterosomal breakdown) occurs, and because the male mouthparts are vestigial.

It resembles *Pyemotes* and differs from *Siteroptes* in food habits, in possessing stout, easily distinguished chelicerae, in possessing a tripartite posterior ventral plate, in lacking a distinct posterior median apodeme, in that claw I of the female is sessile, and because leg IV of the male is furnished with two claws. It resembles neither of the above in that the first hysterosomal segment is tripartite, in its mating habits, in the sex ratio, in that the female trochanter I bears five setae rather than four, in the genital morphology of the male, and because leg I of the male is clawless. In consideration of the above, the genus seems clearly to belong in the Pyemotinae as a specialized form closely related to the Acarophenacinae.

DIAGNOSIS. The females are easily separable from those of all other genera in that legs I are five-segmented, the recurved chelicerae are stout and distinct, the palps are free, and because the first hysterosomal segment is divided into one median and two lateral plates. Additional distinguishing characters are the presence of paired germaria between legs II and III, the dorsal, approximate, capitate peritremes, and the tripartite posterior ventral plate.

Males are distinguished from those of other genera in that the head, while reduced and lacking visible mouthparts, is bilobate rather than peglike, because leg I lacks claws but possesses a flaplike apical dorsal pulvillus, in that leg IV is more slender than legs I and II and bears two unequal claws (the smaller half the width of the larger), in that the aedeagus is ventral, short, bipartite, attenuate, declinate, non-cylindrical, and uncoiled, and because the opisthosoma is not modified (conelike or globelike) to accommodate the genital and clasping structures.

DESCRIPTION OF NON-GRAVID FEMALE. Length, approximately 250μ; width, approximately 150μ; width between anterior condyles of coxae III, approximately 115μ; hysterosoma elliptical-fusiform to elliptical, its posterior margin evenly rounded; body moderately sclerotized.

Gnathosoma. Squarish-fusiform, normally directed anteriorly, length approximately equal to width; palp free, distinct, with single small apical tooth; chelicera stout, styliform, recurved, easily visible; esophageal-pharynegeal pump absent.

Propodosoma. Dorsum. Inversely T-shaped, posterolateral margin rounded, anterior margin forming short, cylindrical cervix, posterior margin overlapping first hysterosomal segment; pseudostigmata located in anterior one-half; three pairs of propodosomal setae; peritremes dorsal and median, close together, nearly transverse, capitate medially; stigmatal openings arcuate, slit-like; esophageal structures not visible. *Venter.* Anterior ventral plate with six pairs of setae, ventrites I and II each with three pairs; external ventral I not forked, medial ventrals II much closer to externals II than to internals II; coxa I attached at nearly a right angle to longitudinal axis of body; apodemes II very strong, straight, complete medially, making angle of approximately 45 degrees with anterior median apodeme; anterior median apodeme extremely large, complete; posterior marginal apodemes weakly developed, distinct only laterally; pleated conjunctival band present between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First dorsal segment divided into one median and two lateral plates, each lateral plate bearing one seta, the median plate bearing a pair; fourth segment with two pairs of setae; fifth segment well developed but usually completely enclosed by fourth in dorsal aspect, bearing two pairs of setae; vulva apicoventral, its margin apparently greatly thickened and sclerotized; one omega-shaped internal genital structure always distinct (fig. 30). *Venter.* Posterior ventral plate tripartite, the two lateral portions overlapping each other mesad to coxae III, the median portion visible posteriorly and mesally as a triangular area beneath and between margins of lateral plates; posterior ventral plate with six pairs of setae; first axillary setae well anterior and mesad of anterior sternocoxal condyles of coxae III; second axillaries well inside and slightly anterior of coxae IV; external presternals well behind and well laterad of internal presternals, arising nearly half way between internals and first axillaries; external poststernals present, on median portion of posterior ventral plate; apodemes III not developed except at anterior sternocoxal condyles III, apodemes IV weak, joining coxae IV at anteromedial corners, progressing mesally and anteriorly to join with apodemes V, the latter joining coxae IV at posterolateral corners and proceeding anteromedially; posterior median apodeme absent; developing eggs in linear series sometimes visible in germaria situated laterally between legs III and IV; band of opisthosomal conjunctival pleats not visible on all specimens; opisthosomal venter entire, bearing a single pair of setae.

Legs. Well developed and long, margins of segments often with sclerotized areas of varying thicknesses; leg I five-segmented, about twice as wide as leg II; tarsus I subconical, not wider than femurogenu I; large, sclerotized areas present along inner margin of tarsus I and medially near outer margin of tibia I; claw I single, stout, sessile, furnished with two stout thumbs; trochanter I with five setae, seta *c* long, aciculate, sparsely plumose, reaching beyond tip of tarsus; seta *d* hooked; sensory pegs of tibiae II and III present; tarsi II and III with eight tactiles; claws II to IV simple, subequal, a single short spur arising in apposition to them at apex of tarsus; pulvilli II to IV distinctly longer than claws; coxa III triangular; coxa IV quadrate, distinctly mesad of III; tarsus IV moderately long, tapering evenly, ratio of femurogenu IV to tarsus IV approximately 1:2.5.

DESCRIPTION OF GRAVID FEMALE. Gnathosoma and propodosoma as described for non-gravid female but entire hysterosoma becoming physogastric, globular, 2 to 3 mm. in diameter.

DESCRIPTION OF MALE. Length, approximately 250μ; width, approximately 170μ; hysterosoma broadly oval, not sharply constricted in vicinity of legs III; conjunctiva granulose, especially laterally and ventrally between anterior and posterior ventral plates.

Gnathosoma. Length, approximately 20μ; width, approximately 35μ; reduced, bilobate, palps lacking, oral appendages and pharyngeal pump not visible, probably lacking as well.

Propodosoma. Dorsum. Dorsal plate well defined, short, subquadrate, enclosing reduced gnathosoma dorsally and laterally, its posterolateral margin bearing three pairs of setae. *Venter.* Apodemes I, II, and anterior median apodeme greatly enlarged, well sclerotized; anterior ventral plate with six pairs of setae, ventrites I and II each with three pairs.

Hysterosoma. Dorsum. Three dorsal plates present, the first bearing three pairs of setae, the second two pairs, and the most caudal two pairs. *Venter.* Posterior ventral plate entire; apodemes III, IV, and V well developed, joining equally distinct posterior median apodeme; external presternals well behind and outside of internal presternals; external poststernals present, slightly inside of and well behind internal poststernals; hind margin of posterior ventral plate indistinct; posterior margin of hysterosomal venter indistinct or distinct; posterior margin of opisthosoma sharply rounded; the halves of the apical aedeagus joining to form a short armature, the latter hooked ventrally near its apex and usually protruding slightly from the body; well defined genital capsule or specialized clasping structures lacking; two pairs of spinelike apical setae flanking aedeagal fissure, one pair of longer setae well ventrad and laterad of these.

Legs. All legs well developed, five-segmented; tarsus I lacking claw, with flaplike dorsal pulvillus; leg IV not greatly modified in size or form; coxa IV subquadrate; trochanter IV not distinctly arcuate; tarsus IV well developed, with two claws, one similar in size to claws of other legs, other twice size of first.

Trochometridium tribulatum, new species

DESCRIPTION OF NON-GRAVID FEMALE. Body elliptical-fusiform, length, 247μ (218-295, $\bar{X} = 253.08 \pm$ S. E. 6.59); width, 146μ 127-187, $\bar{X} = 153.63 \pm$ S. E. 4.88); distance between coxae III, 115μ (108-124, $\bar{X} = 115.22 \pm$ S. E. 1.78); at least posterior portion of propodosomal dorsum and median portion of first dorsal segment coarsely punctate.

Gnathosoma. Squarish-fusiform, large, approximately 48 x 48μ; all gnathosomal dorsals present, internals tiny, arising anterior to and slightly laterad of externals; solenidium II tiny, appearing as a palpal tooth; solenidium I subapical, lanceolate; one tiny seta present on oblique inner face of palpal apex; second palpal seta one-third of length of palp from apex, distance between first and second palpal setae about 7μ; esophageal pump not visible.

Propodosoma. Dorsum. Width between pseudostigmatal sockets 69μ, (63-70, $\bar{X} = 67.00 \pm$ S. E. 0.88); peritremes nearly transverse, irregularly shaped, capitate medially, about 20μ center-to-center, most mesal margins about 3μ apart; stigmatal openings slitlike, arcuate; pseudostigmata barely in anterior half of propodosoma, line drawn between them about 5μ in front of stigmatal setae; propodosomal setae variable, sparsely short-plumose, stigmatals directly below median third of peritremes, about 26μ long; anterior pseudostigmatals short, about 14μ, arising mesad and posterior to internal pseudostigmatal sockets; posterior pseudostigmatals about 70μ long. *Venter.* Six pairs setate, ventrites I and II each with three pairs; median and internal ventrals II longer than rest, 40 to 50μ, internal ventrals I shortest, 12 to 17μ; internal ventral II well anterior to other setae of that ventrite; hind margin of anterior ventral plate irregularly scalloped, not heavily sclerotized, posterior marginal apodemes absent except at sides.

Hysterosoma. Dorsum. Dorsal setae varying in size, always sparsely plumose; anterior portions of all three sections of the first segment covered by posterior margin of propodosoma; dorsal setae I well posterior to laterals I, arising from posterior third of segment, stout, 41μ, 38-43, $\bar{X} = 39.43 \pm$ S. E. 0.40); laterals I longer, about 75μ, otherwise similar to dorsals I; dorsals II as stout as dorsals I and longer, 48μ, (41-48, $\bar{X} = 44.57 \pm$ S. E. 0.68) slightly laterad of latter, spaced about 36μ apart; all setae of segment III equally short, 17μ (17-20, $\bar{X} = 18.21 \pm$ S. E. 0.35), the dorsals about 9μ apart and slightly anterior to laterals; dorsals IV approximately 20μ apart, 51μ (43-54, $\bar{X} = 48.14 \pm$ S. E. 0.99) long, stout, formed as setae of segment I, laterals IV on transverse line with dorsals IV, only a third their length; segment V with two pairs of short, weakly plumose ventral setae about 12μ in length, first pair flanking the vulva, second pair nearly a setal length anterolateral. *Venter.* Lateral divisions of posterior ventral plate arcuate along their mesal margins, these margins overlapping each other in the vicinity of legs III; lateral portions of posterior ventral plate bearing all setae except external poststernals, these borne on triangular median portion of posterior ventral plate (fig. 30); anterior condyles of coxa III well sclerotized, but apodemes III absent; apodeme IV joining apodeme V mesally, delimiting a bell-shaped area which bears the second axillaries and internal poststernals; posterior median apodeme indistinct (distinct as short apophysislike invagination); first axillary well anterior and mesad of anterior condyle of coxa III, second axillary immediately anterior and mesad of anteromedian corner of coxa IV; internal poststernals well (about 10μ) anterior to anterolateral corner of coxa IV, about one and one-half times as far apart as internal presternals; all setae of posterior ventral plate thin, flagellate, sparsely spiculate, 25 to 35μ long; opisthosomal venter distinct, cleft medially, cleft often appearing to contact internal genital sclerotization; setae of opisthosomal venter approximately 15μ long, about as far apart as internal ventrals II.

Legs (all measurements in μ). *Length.* Leg I, —[5] (98-122, $\bar{X} = 113.50 \pm$ S. E. 2.99); leg II, 113 (110-118, $\bar{X} = 113.90 \pm$ S. E. 0.78); leg III, 125 (125-128, $\bar{X} = 125.86 \pm$ S. E. 0.44); leg IV, —[5] (139-152, $\bar{X} = 145.17 \pm$ S. E. 1.82). *Width.* Leg I, 31 (22-32, $\bar{X} = 28.92 \pm$ S. E. 0.79); leg II, 19 (14-21, $\bar{X} = 17.84 \pm$ S. E. 0.47); leg III, 18 (13-18, $\bar{X} = 16.61 \pm$ S. E. 0.50); leg IV, 20 (13-20, $\bar{X} = 18.08 \pm$ S. E. 0.58). *Segment lengths.* tr. I, 42 (40-43, $\bar{X} = 41.78 \pm$ S. E. 0.44); fege I, 22 (20-23, $\bar{X} = 21.44 \pm$ S. E. 0.58); ta II, 35

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[5] Measurement not possible on holotype.

(33-39, $\bar{X} = 36.67 \pm$ S. E. 0.65); fege II, 19 (18-21, $\bar{X} = 19.18 \pm$ S. E. 0.32); tr IV, 41 (41-45, $\bar{X} = 42.66 \pm$ S. E. 0.42); cx IV, 23 (22-25, $\bar{X} = 23.64 \pm$ S. E. 0.25); fege IV, 21 (19-22, $\bar{X} = 20.18 \pm$ S. E. 0.26); ta IV, 52 (48-56, $\bar{X} = 53.33 \pm$ S. E. 0.72). *Setation.* leg I: cx 1T, tr 5T, fege 5T, ti 6T + 2S, ta 7T + 6S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 8T + 1S; leg III: cx 1T, tr 2T, fege 3T, ti 4T + 1S, ta 8T; leg IV: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 7T.

Trochanter I with five setae, the most basal and medial hooked, the apical external dorsal long and whiplike, sparsely plumose, reaching apex of leg or beyond; tibia I distinctly wider than any other leg segment; tarsus I tapering, subconical; solenidium of tarsus II bearing an apical prickle; solenidia of tibiae II and III thin, setalike, 7 to 10μ long, solenidium of tibia IV setalike, longer, 13 to 15μ; coxa IV subquadrate; tarsus IV evenly attenuate, width at apex about three-fourths that of base; ratio of femurogenu IV to tarsus IV approximately 1:2.5.

DESCRIPTION OF MALE. Body broadly oval; length (excluding gnathosoma) 250μ (240-315); width at widest point, 170μ (variation not measurable); sclerites impunctate; conjunctival areas distinctly granulose.

Gnathosoma. Reduced; length, 28μ (variation not measurable); width, 36μ (35-38); bilobate, lobes connected anteriorly by an indistinctly defined membrane. *Setation.* Three pairs of short, dorsal tactiles, one pair of short, one pair of long ventral tactiles, one pair of short, rodlike, ventral sensory setae.

Propodosoma. Dorsum. Weakly sclerotized except for dorsal plate; length of dorsal plate 37μ (variation not measurable); width of dorsal plate 55μ (55-69); dorsal plate with three pairs of setae, anterior pair short, 13μ (13-15), second pair longer, 21μ (20-28), posterior pair at least thrice length of median pair, 72μ (72-105). *Venter.* Median and internal setae of ventrites II nude and flagellate, 100 to 140μ, external ventrals II short, weakly plumose, 18μ (16-20).

Hysterosoma. Dorsum. First hysterosomal plate transversely elliptical, largest of three, overlapping second; lateral margins of second plate narrowing posteriorly, overlapping third; third plate truncate posteriorly, much smaller than second. *Setation.* All setae of first and second dorsal plates weakly short-plumose, setae of third dorsal plate thick and nude; most anterior dorsals I 19μ (19-38) long, posterior dorsals I 82μ (81-151), laterals I 122μ (122-

183); dorsals II 15μ (15-26), laterals II 53μ (33-81); dorsals III short, spiniform, divergent, 5μ (5), laterals III straight, bladelike, 15μ (15). *Venter.* All setae of posterior ventral plate short, thin, barely spiculate, 12 to 23μ long; external presternals usually at least twice as far apart as internal presternals; opisthosomal ventral setae longer and stouter than setae of posterior ventral plate, 28μ (28-46) long, about one and one-half times as far apart as internal poststernals; aedeagus apicoventral, short, approximately 13μ long, bipartite, attenuate, declinate, uncoiled, its bulbose bases divergent within the body; aedeagus usually protruding slightly from aedeagal fissure located posteriorly in fifth segment; two pairs of caudal setae arising from margin of segment V, inner pair stout, divergent, bladelike, 4μ (4-5) long, outer pair straight, spiniform, 3μ (3-4) long, a single pair of short setae about 10μ long (opisthosomal ventrals?) arising well anterior and laterad of these.

Legs (all measurements in μ). *Length.* Leg I, 130 (127-168); leg II, 154 (144-216); leg III, 151 (149-211); leg IV, 118 (118-166). *Width.* Leg I, 25 (25-31); leg II, 26 (26-33); leg III, 17 (17-23); leg IV, 21 (21-28). *Setation.* Leg I: cx 1T, tr 5T, fege 5T, ti 6T + 2S, ta 7T + 8S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 8T + 1S; leg III: cx 1T, tr 2T, fege 3T, ti 4T + 1S, ta 8S; leg IV: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 7T.

Femurogenu II with a single spurlike seta, tibia II with a spurlike seta stouter than that of femurogenu; tarsus II with a pair of stout spurlike setae; trochanters I and II each with a single whiplike seta; sense pegs of tibiae II, III, and IV thin and setalike, 7 to 12μ long; sensory peg of tarsus II bulletlike, 6 to 12μ long; apical sensory setae of tarsi II to IV small, thin, usually difficult to see.

DISTRIBUTION. Oregon to Maryland and as far south as Matamoros, Tamaulipas, Mexico.

TYPE MATERIAL. Holotype female, allotype male, six female (nos. 1, 2, 8, 9, 11, 12) and three male (nos. 14, 15, 16) paratypes from Logan, Green Canyon) Cache County, Utah, July 31, 1956, G. E. Bohart, A. Løken, E. A. Cross, from cells of *Halictus farinosus* Smith.[6] Four female paratypes, (nos. 3, 4, 5, 10) same locality and collectors, July 18, 1956, from mesosoma of *Sphecodes arvensiformis* Cockerell.[6] One female paratype (no. 7) from Lawrence, Douglas County, Kansas, July 15, 1957, A. F. Shinn, from cell of *Calliopsis andreniformis* Smith.[7] One male paratype (no. 17) same locality, collector, and host as preceding, but dated July 27, 1957. One female paratype (no. 6), Fort Meade, Anne Arundel County, Maryland, August 3, 1956, S. R. Joseph, from legs and metasoma of "mutillid." One female paratype (no. 13) 5 mi. NE Adrian, Malheur Co., Oregon, July 31, 1958, R. Eppley, from cell of *Nomia* (*Acunomia*) *melanderi* Cockerell.[8]

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[6] Det. P. H. Timberlake, Citrus Experiment Station, Riverside, Calif.

[7] Det. A. F. Shinn, Stephen F. Austin St. Coll., Nagadoches, Texas.

TYPE REPOSITORIES. Holotype, allotype, one male (no. 14) and eight female (nos. 4, 6, 7, 9, 10, 11, 12, 13) paratypes in the Snow Entomological Museum, The University of Kansas; one male (no. 17) and one female (no. 3) paratype in the United States National Museum, Washington, D. C.; one male (no. 16) and one female (no. 2) paratype in the Zoologisches Institut der Universität Erlangen, Erlangen, Germany; one male (no. 15) and one female (no. 5) paratype in the British Museum (Natural History), London, England; one female paratype (no. 1) in Oregon State College collection, Corvallis, Oregon; one female paratype (no. 8) in the private collection of the author.

SPECIMENS EXAMINED AND HOSTS. In addition to the type material the following specimens have been examined: IOWA: Sioux City, *ex Calliopsis andreniformis*. NEBRASKA: Lincoln, *ex Calliopsis andreniformis*. TAMAULIPAS: Matamoros, *ex Nomia* (*Epinomia*) *nevadensis bakeri* Cockerell. TEXAS: Cotulla, *ex N. n. bakeri*.

HABITS. As far as is known, the species is a parasite of larval bees. Observations concerning its life history were made by the author while studying a nesting area of *Halictus farinosus* Smith, a large, soil-nesting, social halictine bee, in Green Canyon, Cache County, Utah, during late July and early August of 1956. Several cells of this bee were found to be infested with *Trochometridium tribulatum*, including two that contained gravid female mites and eggs or eggs and immatures. The contents of the cells were reared in the laboratory and observations were made on their development.

The eggs are large (160-200μ), spherical, translucent to milky-white. They are deposited in bunches within the cell, apparently normally, through the vulva, rather than through the rupture of the hysterosomal wall as described for *Siteroptes cerealium*. It resembles this species, however, as well as members of the genus *Pyemotes* in the complete suppression of active immature stages. The egg hatches into a quiescent form which gradually increases in size, changes shape and color, and molts into an active adult mite of either sex.

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[8] Det. E. A. Cross, Northwestern State College, Natchitoches, La.

The shell splits, disclosing the quiescent embryo enclosed within an embryonic sheath. At this point only the two anterior pairs of legs protrude, and the young embryo resembles a minute ptyctime. Embryos at this stage possess two pairs of clawless hysterosomal lobes and presumably pass the larval stage while within the chorion. As the embryo grows, it casts aside the halves of the shell and takes on a more definite shape, gradually acquiring a pale reddish tinge. Both sexes at this stage are fusiform, having the two anterior pairs of legs extended forward and touching each other apically, the two posterior pairs extending behind, also touching apically. Such embryos appear to have only one enveloping membrane. The adults emerge from this membrane head first, and mites having only the first two pairs of legs free are commonly seen scraping against the substratum to peel away the posterior half of this enveloping sac. Although it was not possible to ascertain the exact duration of the immature stages, some information was obtained. An egg mass collected on July 31 from a bee cell which also contained a second gravid female mite (this mite proved to contain no mature eggs when dissected) was observed in the laboratory. On August 2, the first egg hatched, and by August 8th most of the viable eggs had hatched. On this latter date several adult males were already present. By August 10th, both males and females were present in some numbers, males comprising about 40 to 45 percent of the total population. On August 16th, approximately three-fourths of the mites had reached adulthood, at which time the total number of adults was 210. Sixty (29 percent) of these were males. Male mortality was seen to begin within two days of the time of their emergence, and what percentage survived to contribute to the above total is not known. Observations made of infested cells shortly after the completion of mite emergence indicate that the percentage of males is very low (2 percent), or that males are absent entirely. It appears, therefore, that males emerge first and die first, their complete disappearance coinciding with the time of emergence of the latest females. The male/female ratio is high, equalling or surpassing unity in the early half of the emergence span. In *Siteroptes cerealium*, the usual male/female ratio is .04 to .05, in *Pyemotes* species, .035 to .0375 (after Herfs, 1926).

The two sexes differ as greatly in their locomotory movements as in their physical appearance. Females exhibit a steady gait, usually utilizing only legs II and III. Legs IV are occasionally used in walking, but generally seem to serve as organs of balance under conditions involving smooth terrain. The huge first pair of legs are used as sensory appendages in the same manner as those of Scutacaridae. They are carried slightly diverging before the advancing mite, often making alternate "pawing" motions in the air, or they may be tapped on the substrate as the mite proceeds. On several occasions the pawing motions were seen with legs I held vertically above the propodosoma. Males, on the other hand, are excessively awkward. Apparently, all four pairs of legs are used for locomotory purposes, but in an uncoordinated manner. Movements are halting and clumsy, often consisting only of slow, turning motions, and they seem incapable of walking any great distance. No differences in gait were observed when males were isolated in separate dishes. (Perhaps the excessive awkardness of the male may help to explain the comparatively high male/female sex ratio in the species.)

Mating was observed in this species, the process differing considerably from that described for *Siteroptes* and *Pyemotes.* As soon as males emerge, they begin to wander about, during which time they may attempt to mate with any females encountered. It is probable that, as in *Pyemotes,* they are not stimulated by inseminated females, since they make no attempt to copulate with many of the females passing within reach. Perhaps this may be a behavioral rather than a physiochemical response on the part of the female, since many females seem to actively avoid or rebuff the males. Having found a partner, the male slides underneath her body, still with his ventral surface toward the substrate. Reaching upwards with legs I and II, he grasps the anterior portion of the female hysterosoma and holds the female in this position during copulation, her venter pressed tightly against his dorsum. The apex of the male opisthosoma is then directed upward to make contact with the vulva of the female. Contact seems to last but an instant. In at least one instance, the female was newly hatched, having just previously shed her embryonic membrane. Males were never seen to pick up the quiescent nymphs and attempt copulation as has been described for related forms.

Although certain parts of the life history seem clear, much is unknown and the following account is largely speculative.

Young, presumably mated females are found within the nests of the host. Although they tend to congregate in masses within the cells in which they are born, this behavior must be later modified so that they escape from the cells and disperse inside the bee burrows. There they may find the original mother bee (in the case of *Halictus farinosus*), or the succeeding generation of bees emerging the same year, or (*Nomia, Calliopsis*) they overwinter within the burrow to find the brood emerging the following spring. In any event, it seems clear that mites leaving the nest usually are dispersed by the adult bees or their parasites or inquilines. Young female mites have been found clinging to the mesosoma or head of adult *Halictus farinosus* Smith, *Nomia nevadensis bakeri* (Cockerell), *Sphecodes arvensiformis* Cockerell, and an unidentified mutillid. Concerning the latter two, the first is a known parasite of *Halictus farinosus* and it is likely that the second is also a bee parasite. In searching for a suitable host cell, the female *S. arvensiformis* may puncture the caps of a sealed cell (G. Bohart and Cross, unpublished). It is possible that this behavior may facilitate the dispersal of mites from infested cells.

The young females must obviously find a host larva. Those attached to female bees or bee parasites may drop off into cells newly constructed or provisioned and wait, probably inside the cell, for the bee larva to reach the proper stage of development. The author has seen slides of young female mites labelled "from the larva of *Calliopsis andreniformis*." No cells found by the author in Utah contained both mites and bee larvae. Presumably the host is killed, perhaps by a toxic salivary secretion similar to that of *Pyemotes* sp. A. Shinn (in litt.), working with *Calliopsis andreniformis* in Kansas in 1957-58, reports the same finding. At least in *H. farinosus* the larva may be killed before it finishes feeding, as indicated by a small amount of pollen found in at least one parasitized cell of *H. farinosus*. It is presumed that the female feeds by first piercing the skin of the host with the needlelike chelicerae, then sucking body fluids. Of interest is the fact that both Shinn (in litt.) in Kansas and the author in Utah have never found more than two gravid female mites in a bee cell.

As the female feeds, the entire hysterosoma begins to swell and become globelike, this continuing until she has increased her original size many times. The diameters of the hysterosomata of gravid specimens from Utah and from Kansas are 2.3 and 3.0 mm., respectively. Within this enormously distended sphere, the eggs are formed.

Resinacarus Vitzthum

Resinacarus Vitzthum, 1927, Sitzungsberichte der Gesellschaft Naturforschender Freunde Berlin, 1927, pp. 89-110. Type, *Resinacarus resinatus* Vitzthum, 1927, by original designation.

The single species *resinatus* included in this genus has not been seen since it was originally described. *Resinacarus* will therefore not be described herein and the reader is referred to the original description.

Partly due to Kramer's (1877b) incorrectly ascribing (see p. 156) but two pairs of dorsal propodosomals to *Pygmephorus spinosus,* confusion has existed in assigning forms to *Resinacarus.* Particularly in the United States, species properly belonging to *Pygmephorus sensu stricto* (as defined in this paper) have been incorrectly placed in this genus. In actuality, *Resinacarus* appears to be a unique form and may be separated from the remaining genera in the family by the characters given in the above keys.

The male of *Resinacarus* resembles that of some Pyemotinae and some Acarophenacinae in the following respects: functional gnathosoma present; leg IV similar to that of the female; pronounced genital capsule lacking; propodosoma with four pairs of dorsal setae.

The female resembles some Acarophenacinae as well as some Pyemotinae and differs from those of the Pygmephorinae in that coxa IV is triangular and similar to coxa III, because apodemes IV arise from the anterior sternocoxal condyles of legs IV, and in possessing a pair of opisthosomal sternals; it resembles the Acarophenacinae and differs from the other two subgenera in having only three pairs of anterior sternal setae and four pairs of posterior ventral setae; it resembles some Pygmephorinae and Pyemotinae and differs from the Acarophenacinae in that coxa I appears to arise only slightly obliquely to the longitudinal axis of the body, in that the gnathosoma is elongate, free, and decumbent, and in body shape.

In consideration of the above, the author tentatively places *Resinacarus* as a specialized genus (fused tibiotarsus I, loss of two pairs of ventral setae) within the subfamily Pyemotinae.

Vitzthum took *resinatus* from tubes bored in spruce resin by *Myolepta* sp. and another unidentified species of syrphid fly. He believed the mite to be associated with the fungus *Sporotrichum flavissimum,* therefore similar to *Siteroptes* in food habits.

Acarophenacinae, new subfamily

Description of Non-gravid Female. Small mites, usually 200μ long or less, rarely 300μ; shape oval to short-fusiform, posterior margin of hysterosoma usually sharply rounded; integument weakly to moderately sclerotized, lacking "pebblings" or scalelike engravings; most lateral portions of posterior ventral plate not striate.

Gnathosoma. Distinct and normally directed anteriorly or hidden within propodosoma; palps fused to gnathosoma, not distinct; chelicerae enlarged, distinct, needlelike or bladelike.

Propodosoma. Dorsum. Entire or bipartite; pseudostigmata present or (usually) absent; two or three pairs of dorsal propodosomal setae present; posterior margin of propodosoma meeting or overlapping anterior margin of first hysterosomal tergum; esophageal "finned structures" not visible, probably lacking. *Venter.* Anterior ventral plate with three pairs of setae or less; secondary transverse suture lacking.

Hysterosoma. Three to five visible segments, segment V reduced, sometimes vestigial; segment V, if distinct, with two pairs of setae or fewer; posterior portion of vaginal wall not sclerotized or enclosed within enlarged, globose to elliptical pumplike structures; definitive anterior and posterior genital sclerites absent but various internal opisthosomal sclerites sometimes present; opisthosoma short, usually not much longer than distance between anterior margin of coxa III and posterior margin of coxa IV; setae of opisthosomal venter present or absent.

Legs. Leg I 4 or 5 segmented, arising at nearly a right angle to the longitudinal axis of the body or distinctly obliquely; trochanter I with three or four setae, seta *c* setiform; claws I and IV, II to IV, or I to IV may be absent or all claws may be present; pinnacula absent; coxa IV subcordate or bandlike, never quadrate or rectangular; tarsus IV not greatly elongate, never more than three and one-half times length of fermurogenu IV.

Key to the Genera of the Subfamily Acarophenacinae (Females)

1(*a*). Leg I with five segments; pseudostigmata present....*Caraboacarus,* p. 130
1(*b*). Leg I with four segments; pseudostigmata absent.................2
2(*a*). Leg IV with claws; peritremes opening dorsally; dorsal propodosomal U-shaped apodeme lacking.....................*Paracarophenax,* p. 132
2(*b*). Leg IV without claws; peritremes opening anteriorly; dorsal, propodosomal U-shaped apodeme present..............................3

3(*a*). Tibiotarsus I with stout, sessile claw; posterior ventral plate with five pairs of setae .... *Acarophenax*, p. 138
3(*b*). Tibiotarsus I clawless; posterior ventral plate with three or four pairs of setae .... *Adactylidium*, p. 142

Caraboacarus Krczal

(Figs. 41-42)

Caraboacarus Krczal, 1959, Beiträge zur Systematik und Ökologie mitteleuropäischer Acarina. Bd. I: Tyroglyphidae und Tarsonemini, Teil 2, p. 570. Type, *Caraboacarus stammeri* Krczal, 1959, by original designation.

This genus is known from various carabid genera in Europe and the central United States. Although possessing several characters considered to be specialized, including the loss of claws I and IV, loss of the opisthosomal sternals, the fusion of tibia and tarsus IV, small size, the oblique articulation of coxae I, the possession of only two pairs of propodosomal setae, and the modified, paddlelike ventral setae, it is tentatively placed as the most primitive form in the subfamily because legs I are five-segmented, pseudostigmata are retained, the anterior ventral plate bears three pairs of setae, the posterior plate bears six pairs, gnathosoma is free, propodosomal dorsum is entire, trochanter I has four setae, tarsus II has seven setae, the solenidia of both tibiae II and III are present, and because the fifth segment is relatively well developed.

Despite its wide host range and distribution, the genus is known to include but two species, one undescribed. Only the non-gravid females are known. *Diagnosis.* Females may be differentiated from those of all other genera by the following combination of characters: legs I five-segmented, gnathosoma free, at least twice as wide as long, palps fused, body short-fusiform, opisthosoma very short, projecting behind posterior margins of coxae IV only about as much as gnathosoma projects forward from anterior margins of coxae I.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 160 to 173μ; width 111 to 120μ; width between anterior condyles of coxae III 66 to 77μ; hysterosoma ovate-fusiform; body weakly sclerotized or not, with or without coarse punctures.

Gnathosoma. Distinct, bow-shaped, at least twice as wide as long, directed anteriorly; palp indistinct, fused with gnathosoma; chelicera stout, recurved, bladelike, easily visible; pharyngeal-esophageal pump present but dorsal rather than ventral.

Propodosoma. Dorsum. Broadly trapezoidal, nearly rectangulate; posterior margin meeting or hidden beneath first hysterosomal segment (In mounted specimens of the same series, both conditions occur. Since the overlap between the two sclerites is small, these discrepancies probably occur during mounting); prominent dorsal U-shaped apodeme lacking; pseudostigmata present, normal, located in posterior one-half, arising well laterad; two pairs of propodosomal setae, one pair of pseudostigmatals missing, remaining pair less than twice length of stigmatals; peritermes circular to oval, situated at anterolateral corners of dorsum, often hidden or indistinct; two pairs of large, sclerotized "tubercles" present, one pair anteromesad of stigmatals, a second, larger pair behind pseudostigmatals; internal atria dorsal, elongate, moderately prominent. *Venter.* Ventrites I lamellate anteriorly or normal, sometimes (*stammeri*) with a pair of circular, suckerlike structures; anterior ventral plate with three pairs of setae, ventrites I with one pair, ventrites II with two pairs, external ventrals I lacking; line of articulation of coxa I oblique to longitudinal axis of body; apodemes II wide, becoming platelike laterally, arcuate, complete, making angle of about ninety degrees with anterior median apodeme, latter well developed, extending posteriorly to line drawn between posterior condyles of coxae II; pleated conjunctival membrane between propodosoma and hysterosoma not visible; posterior marginal apodemes well developed medially, incomplete at sides.

Hysterosoma. Dorsum. First segment entire, meeting or extending slightly over posterior margin of propodosoma; fourth segment with two pairs of setae; segment V reduced, cuplike, concealed dorsally by fourth or nearly so, bearing one or two pairs of setae, inner pair tiny, spinelike, often indistinct; vulva apical; genital sclerotizations variable, seemingly dependent upon mount. *Venter.* Posterior ventral plate entire, bearing six pairs of setae, at least one pair modified spinelike; second axillaries nearly directly mesad of anterior condyles of coxae IV; external presternals well laterad of and posterior to internal presternals, much closer to latter than to first axillaries; external poststernals arising directly behind but some distance from internal poststernals, near line drawn between most mesal margins of coxal foramina IV; apodemes III well developed, arcuate, incomplete medially; apodemes IV also well developed, straight, complete or nearly so, arising near posterior margins of coxae III and proceeding anteromedially at angle of about 45 degrees; apodemes V absent; posterior median apodeme distinct, its posterior termination in vicinity of internal poststernals, band of opisthosomal conjunctival pleats visible or not; opisthosoma characteristically short, much shorter than distance between anterior margins of coxae III and posterior margins of coxae IV; opisthosomal venter entire, one pair of setae present or not.

Legs. Well developed, margins of segments often with well sclerotized areas of varying thickness; leg I with five segments, distinctly shorter and thinner than leg II; tarsus I short and tapering, narrower than other segments of leg; lateral sensory spot absent; claw I lacking; tibia about same breadth as femurogenu; trochanter I with four setae, seta *c* stout, long, aciculate, reaching nearly to largest tarsal solenidium; seta *e* peglike or clavate; trochanter II with three setae, femurogenu II with three; trochanter III with two setae, femurogenu III with three; tarsus II with seven setae and a sensory peg, tarsus III with seven setae; solenidia of tibiae II and III present, basal; claws II and III present, short and stout, with a large mesal lobe; claws IV lacking; pulvilli II and III much longer than claws; coxa III subcordate, coxa IV bandlike, distinctly mesad of coxa III; tibia and tarsus IV fused; tibiotarsal suture distinct half way around leg; most elongate seta of leg IV dilated bladderlike basally.

HABITS. Because of the greatly enlarged chelicerae of these mites, it is probable that they are parasites. All specimens known to date have been taken from beneath the elytra of various carabid beetles, principally of the genera *Harpalus* (in Europe) and *Agonoderus.*

SPECIMENS EXAMINED. Two species (one probably *stammeri*) from Kansas and Michigan, from the following hosts: *Agonoderus comma* Fabricius,[9] *A. pallipes* Fabricius, *A.* sp., "large black carabid," "small black carabid."

Paracarophenax, new genus

(Figs. 45-47)

Type, *Paracarophenax dybasi,* new species.

This genus includes at least four species, two of which are undescribed. One of these, *P. dybasi,* is described herein.

P. dermestidarum (Rack) and *P. bambergensis* (Krczal) are found upon various dermestids and upon nitidulids, respectively. The habitat of *P. dybasi* (in debris under decaying fruit) suggests a host similar to the latter. An undescribed species near *P. dybasi* has been taken from a Panamanian cerambycid. Rack (1959), gives an excellent account of *P. dermestidarum.*

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[9] Det. G. E. Ball, 1960.

Members of the group are closely related to *Acarophenax* but are considered less specialized in that claws I to IV are retained, in that the propodosomal arcula is less specialized, because segment V is relatively well developed and bears a pair of setae, and because the solenidium of tibia II is retained. In addition, the peritremes are dorsal in some (but not all) species.

The male of only one species, *P. dermestidarum,* is known.

DIAGNOSIS. Females differ from those of all other genera in the family by the following combination of characters: anterior ventral plate with only two pairs of setae; gnathosoma concealed within the propodosoma or nearly so; chelicerae stout, easily visible; legs II to IV with claws.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 200 to 300μ; width, 98 to 180μ; width between anterior condyles of coxae III 65 to 110μ; hysterosoma subovate, its posterior margin narrowly rounded; body weakly sclerotized and without coarse punctae.

Gnathosoma. Outlines indistinct, nearly completely enclosed within propodosoma, not visible in dorsal aspect; palpi fused with gnathosoma, indistinct; chelicerae stout, styliform, recurved, easily visible; elongate, spindle-shaped pharyngeal-esophageal pump present, often indistinct, extending posteriorly as far as mesal portions of coxae II.

Propodosoma. Dorsum. Dorsal propodosomal plate broad, shieldlike, overlapping bases of legs II, projecting anteriorly, lobelike, between legs I, sometimes ventrally to gnathosoma; posterior margin overlapping first hysterosomal segment; dorsal, U-shaped apodeme lacking; peritremes dorsal or dorsolateral, located near anterolateral extremities of propodsoma, not enclosing gnathosoma laterally; internal atria drop-shaped, ill defined or not visible; pseudostigmata absent; two or three pairs of propodosomal setae, anterior pairs absent or distinct, if distinct then less than half as long or wide as remaining pairs, located laterad of cheliceral bases. *Venter.* Anterior ventral plate with two pairs of setae, ventrites I with one pair, second pair on or approximate to apodemes II; ventral externals I lacking; coxa I attached at a right angle to longitudinal axis of body or slightly oblique; apodemes II moderately to weakly developed, long, straight, incomplete medially, sometimes narrowly so, making angle of about 45 degrees to longitudinal plane of body;

anterior median apodeme absent to well developed; pleated conjunctival band between propodosoma and hysterosoma indistinct; posterior marginal apodemes ill defined.

Hysterosoma. Dorsum. First dorsal segment entire, overlapped anteriorly by propodosoma; third segment with one or two pairs of setae; fifth segment reduced, cuplike, usually not completely hidden beneath fourth in dorsal aspect, bearing a single pair of apicoventral setae; vulva apical, apical portion of vagina not heavily sclerotized or enclosed in heavily sclerotized pumplike structure. *Venter.* Posterior ventral plate with five pairs of setae, entire or with tripartite posterior margin; second axillary well mesad of anterior sternocoxal condyle IV; one pair of poststernals lacking; apodemes III weak or lacking except at anterior sternocoxal condyles of coxae III; apodemes IV weakly to moderately developed, nearly straight, incomplete medially, arising from posterior margin of coxae III and proceeding anteromedially; apodemes V absent; band of pleated opisthosomal conjunctiva indistinct; opisthosoma short, distinctly shorter than distance between anterior margin of coxa III and posterior margin of coxa IV; opisthosomal venter entire, bearing a single pair of setae.

Legs. Well developed and long; leg I four-segmented, distinctly stouter than remaining legs; tibiotarsus I subelliptical to rectangular, distinctly wider than other segments of leg; large, rounded, mediolateral sclerotized area near outer margin of tibiotarsus I midway between base and claw; claw I single, stout, sessile, furnished with a large, toothed thumb; trochanter I with three setae, seta *c* stout and aciculate, not or scarcely reaching tibiotarsal sensory spot, seta *d* arcuate; trochanter II with three setae, femurogenu II with one or three; trochanter III with one or two setae, femurogenu III with one or three; solenidium of tibia II present, that of tibia III absent; tarsus II with six tactile setae and a sensory peg, tarsus III with six tactiles; solenidum of tarsus II in basal third of segment; pretarsi II to IV elongate, two-thirds to nearly as long as tarsi; claws II to IV well developed, simple, pulvilli II to IV also well developed; coxa III short-triangular in ventral aspect, coxa IV broadly crescentic in ventral aspect, distinctly mesad of coxa III; femurogenu IV with one or two setae; tarsus IV only slightly longer than tibia IV, tapering evenly; ratio of femurogenu IV to tarsus IV about 1:2.

DESCRIPTION OF GRAVID FEMALE.[10] Gnathosoma as described for non-gravid female; propodosoma and hysterosoma becoming physogastric and spherical, sometimes reaching 700μ.

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[10] Specimens of these stages not seen; information taken from original description of *Acarophenax dermestidarum* (Rack).

DESCRIPTION OF MALE.[10] Similar to that of *Acarophenax;* slightly smaller than female; posterior margin rounded; body dorsoventrally flattened; opisthosoma not greatly modified to form connate or trapezoidal genital capsule.

Gnathosoma. Hidden within propodosoma, chelicerae functional.

Hysterosoma. Venter. Generally agreeing with description of *Acarophenax* but appearing to possess two pairs of setae rather than two pairs of suckers on genital plate; apicoventral suckers also seemingly absent; apodemes III and IV are complete medially or nearly so.

Legs. All legs shorter than those of female, leg IV subequal to or slightly longer than leg III, otherwise agreeing with the description of *Acarophenax.*

Species thought to belong in *Paracarophenax:*

bambergensis (Krczal, 1959) (*Acarophenax*)
dermestidarum (Rack, 1959) (*Acarophenax*)
dybasi, new species
ipidarius (Redikortsev, 1947) (*Pediculoides*)

HABITS. Unknown except for the excellent account of the habits of *P. dermestidarum* (Rack). In general, the life history of that species agrees well with that of *Acarophenax tribolii.* Several interesting differences, and points not noted by Newstead & Duvall should perhaps be mentioned here, however.

Females of *P. dermestidarum* differ from those of *A. tribolii* in their locations on the adult host, those of the latter occurring principally under the wings, those of the former preferring the venter, principally that of the thorax. Concerning the question of the young females of *dermestidarum* parasitizing adult beetles, see p. 141. Unlike those of *A. tribolii, dermestidarum* females will leave their adult host and actively seek food if the latter are incapable of oviposition. Rack mentions that complete physogastry may be attained following the consumption of about half the contents of a single beetle egg, the active feeding period lasting 24 to 30 hours. The number of offspring per female is higher than in *tribolii,* and ranges from 3 to 27. As in the latter species it is directly correlated with the amount of physogastry attained by the mother.

It was ascertained by Rack that mating in *P. dermestidarum* occurs within the body of the mother, only a single male being produced in any one female. After impregnating its sisters, this male often initiates the maternal hysterosomal breakdown and subsequent birth of the offspring by pushing its way through the body wall of its mother. If neighboring females are available, this newly escaped male may climb upon one of them and wait for mating to begin within. When such activity commences, it may then claw its way into the body of the mother concerned and assist the resident male in mating the females. During its period of waiting, this intruding male may occasionally puncture the body of the "host" mother to feed.

The young females of *dermestidarum,* unlike those of *tribolii,* need no conditioning period upon the adult beetles before attacking their eggs to begin feeding and physogastry.

SPECIMENS EXAMINED. In addition to the type series of *dybasi,* the following have been examined: *Species No. 1.* PANAMA: Barro Colorado Is., 2 ♀ ♀ from body of cerambycid.

Paracarophenax dybasi,[11] new species

DIAGNOSIS. This species is closest to *P. bambergensis* (Krczal), from which it differs in that the posterior margin of the posterior ventral plate is distinctly tripartite, in that all dorsal setae except laterals IV are stout and sparsely plumose, and because tarsus II and tarsus III possess two and one spinelike setae, respectively.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 257μ (257-279, $\bar{X} = 264.33$); width, 172μ (172-182, $\bar{X} = 178.00$); distance between anterior sternocoxal condyles III, 98μ (98-110, $\bar{X} = 105.00$).

Gnathosoma. Cheliceral bases widely separated, chelicerae large, bladelike, arcuate, converging posteriorly, then recurved abruptly anteriorly to enter buccal cavity.

Propodosoma. Dorsum. Large, hemispherical except for deep anterolateral excavations marking insertions of coxae I; anterior margin seemingly bending ventrally to cover gnathosoma anteriorly as well as dorsally; peritremes circular, dorsal, in anterior one-quarter, separated by less than twice the width of one; stigmatal openings circular, distinctly visible within peritremes; one pair of setae (stigmatals?) about one peritremal diameter in front of peritremal margin, short, bristlelike, directed anteriorly (position easily altered during mounting); pseudostigmatals stout, spiculate, blunt apically, anterior pair subequal in length to posterior pair and arising less than two areolar widths anterior to a line drawn between them; anterior pseudostigmatals about 43μ apart, posterior pseudostigmatals about 34μ laterad of respective anterior pseudostigmatals. *Venter.* Setae of anterior ventral plate nude, short, ventrals II about 31μ long, more than thrice length of ventrals I and distinctly mesad of them.

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[11] This species is named in honor of Henry S. Dybas, Associate Curator of Insects, Chicago Natural History Museum, who collected the type series.

Hysterosoma. Dorsum. All setae of dorsum except laterals IV stout, spiculate, apically blunt; laterals IV flagellate; dorsals I well posterior to laterals I, 21μ (21-24, $\bar{X} = 22.80$) long, 68μ (68-72, $\bar{X} = 69.40$) apart; laterals I slightly longer than dorsals I, 26μ (25-26, $\bar{X} = 25.60$), closer to respective dorsals than dorsals are to each other; dorsals II as laterals I, 85μ (85-92, $\bar{X} = 90.00$) apart; dorsals III 18μ (15-19, $\bar{X} = 17.00$), 15μ (15-23, $\bar{X} = 20.60$) apart, laterals III usually slightly longer than dorsals III and posterolaterad of them by about their own length; dorsals IV 14μ (14-15) long, 20μ (20-24) apart; laterals IV 17μ (17-21, $\bar{X} = 18.30$) long, well anterolaterad of dorsals IV; setae of segment V well ventral, short, about 8 to 9μ. *Venter.* Posterior margin of posterior ventral plate shallowly tripartite; apodemes III vestigial, developed only at anterior sternocoxal condyles of coxae III; apodemes IV moderately developed, weakly sinuate, terminating well anterior to but on a longitudinal line with internal poststernals; all setae of posterior ventral plate short, nude, flagellate, about 11 to 23μ long; internal presternals arising in a straight line with external presternals and poststernals; external poststernals arising from center portion of tripartite ventral plate on (or nearly on) line drawn between posteromesal margins of coxal foramina IV; posterior margin of opisthosomal venter with distinct median excavation; opisthosomal ventrals 20μ (20-26, $\bar{X} = 22.80$) apart, 23μ (19-23, $\bar{X} = 21.20$) long, nude, flagellate.

Legs (all measurements in μ). *Length.* Leg I, 72 (69-72, $\bar{X} = 69.60$); leg II, 90 (90-94, $\bar{X} = 91.80$); leg III, 96 (94-104, $\bar{X} = 97.40$); leg IV, 110 (110-117, $\bar{X} = 112.00$). *Width.* Leg I, 24 (22-24, $\bar{X} = 23.60$); leg II, 17 (17-20, $\bar{X} = 18.21$); leg III, 14 (14-15, $\bar{X} = 14.20$); leg IV, 17 (15-17, $\bar{X} = 16.20$). *Segment lengths.* Tr I, 22 (22-24, $\bar{X} = 23.20$); tita I, 36 (34-36, $\bar{X} = 34.80$); tr II, 31 (26-31, $\bar{X} = 30.20$); ta II, 37 (33-37, $\bar{X} = 34.60$); ti III, 18 (17-18, $\bar{X} = 17.20$); ta III, ($\bar{X} = 33.00$); cx IV[12] 22 (22-24, $\bar{X} = 22.60$); tr IV, 42 (40-44, $\bar{X} = 42.40$); fege IV, 13 (12-13, $\bar{X} = 12.60$); ta

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[12] Distance measured between centers of anteroventral and posterodorsal sternocoxal condyles.

IV, 43 (41-43, $\bar{X} = 42.40$). *Setation.* Leg I: cx 1T, tr 3T, fege 4T, tita 14T + 5S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 7T + 1S; leg III: cx 1T, tr 2T, fege 3T, ti 4T, ta 7T; leg IV: cx 1T, tr 2T, fege 2T, ti 4T, ta 6T.

Seta *c* of trochanter I stout, blunt apically, seta *d* recurved; tibiotarsus I with two clavate and three setiform solenidia; basal clavate solenidium distinctly longer than and half the width of the distal; first seta basad of proximal clavate solenidium setiform, not lanceolate or flagellate; claw I with distinct mesal tooth on inner surface, otherwise without rounded basal dilation; thumb present, enlarged, bidentate; trochanter II, femurogenu II, and tibia II lacking spiniform setae, two such setae present on tarsus II, one on tarsus III; solenidium of tibia II elongate, weakly clavate, that of tarsus II less than half as long and twice as wide, both well distad of bases of their respective segments; tarsus IV lacking elongate, flagellate seta, slender, tapering evenly, ratio of femurogenu IV to tarsus IV 1.3.3 (1:3.2 to 1:3.6).

Distribution. Known only from the type locality.

TYPE MATERIAL. Female holotype and four female paratypes (nos. 1-4) from S. W. shore, Lake Clay (nr. Lake Placid), Highlands Co., Florida, June 14, 1955, H. S. Dybas, in debris under decaying fruit (berlese sample).

TYPE REPOSITORIES. Holotype and one paratype (no. 3) in the Chicago Natural History Museum, Chicago, Illinois. Two paratypes (nos. 1, 4) in the Snow Entomological Museum, The University of Kansas. One paratype (no. 2) in the U. S. National Museum, Washington, D. C.

Acarophenax Newstead & Duvall

(Figs. 43-44)

Acarophenax Newstead & Duvall, 1918, Royal Society Report No. 2 of Grain Pests (War) Committee, pp. 19-25, pl. VII and VIII. Type, *Acarophenax tribolii* Newstead & Duvall, 1918, by original designation.

This genus includes at least three forms, two of which are undescribed. All are probably egg parasites of various beetles. The cosmopolitan *A. tribolii* attacks the eggs and perhaps the adults of *Tribolium,* but it has been recorded from other tenebrionids (*Latheticus, Gnathocerus*) as well. One undescribed form seen by the author was taken from the nest of a flicker (*Colaptes*), in which it was perhaps parasitic upon a resident beetle. A second (undescribed) form is known from laboratory cultures of *Crypto-*

lestes ferrugineus (Steph.). *A. bambergensis* Krczal is parasitic upon nitidulids. This last named species as well as *A. dermestidarum* Rack, are placed in a new genus, *Paracarophenax* (p. 132).

DIAGNOSIS. The females differ from all other genera in the family by the following combination of characters: anterior ventral plate with two pairs of setae, gnathosoma reduced and fused with the propodosomal arcula, concealed or nearly so, chelicerae stout and easily visible, legs II to IV lacking claws and possessing pretarsi which are nearly as long as the tarsi.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 105 to 198μ; width, 66 to 128μ, width between anterior sternocoxal condyles of coxae III, 40 to 83μ; hysterosoma narrowly to broadly oval, posterior margin narrowly rounded; body weakly sclerotized, without coarse punctures.

Gnathosoma. Outlines indistinct, seemingly at least partially fused with subdorsal propodosomal arcula, not or scarcely visible in dorsal aspect; palpi fused, indistinct; setation reduced, consisting of one pair anteriorly or anterodorsally, one pair of ventral palpal setae and sometimes a pair of palpal solenidia, and one or two pairs of lateroventrals, the most basal of which may be the displaced internal ventrals I; chelicerae stout, styliform, recurved basally, easily visible; large spindle-shaped pharyngeal-esophageal pump visible internally, extending posteriorly to anterior mesal portions of coxae II, salivary ducts distinct dorsal to this pump.

Propodosoma. Dorsum. Dorsal plate broad, shieldlike, at least partially projecting over gnathosomal region anteriorly, posterior margin overlapping first hysterosomal segment; internal U-shaped apodeme of arcula prominent dorsally, its arms continuous anteriorly with peritremes; peritremes in "shoulders," directed anteriorly or turning ventrally, enclosing gnathosoma laterally; internal atria prominent, dorsal, drop-shaped or circular; pseudostigmata lacking; two or three pairs of propodosomal setae, if three, anterior pair small, indistinct. *Venter.* Anterior ventral plate with two pairs of setae, ventrites I and II each with a single pair; ventral externals I lacking; coxa I (as seen in ventral aspect) attached at a right angle to longitudinal axis of body or nearly so; apodemes II very strong, straight, incomplete medially or nearly so, making angle of about 45 degrees or less with anterior median apodeme, the latter well developed; posterior marginal apodemes well defined, nearly complete; pleated conjunctival band between propodosoma and hysterosoma indistinct.

Hysterosoma. Dorsum. First segment entire, overlapped anteriorly by propodosoma, fourth segment with one (rarely) or two pairs of setae, completely enclosing fifth segment in dorsal aspect; fifth segment much reduced, sometimes vestigial, bearing one pair of setae or none; vulva apical or apicoventral; internal hysterosomal structures absent or at least indistinct. *Venter.* Posterior ventral plate entire, bearing three or five pairs of setae; hind margin of posterior ventral plate broadly rounded or shallowly trilobate; second axillaries well mesad of and slightly anterior to legs IV; external presternals (may be internal poststernals) lacking; external poststernals arising medially or absent; apodemes III rather poorly developed, absent or short and straight and directed anteromedially; apodemes IV strong, straight, incomplete, arising at anterior sternocoxal condyles of coxae IV and proceeding anteromedially; apodemes V lacking; posterior median apodeme absent or reduced to a short line posterior to mesal terminations of apodemes IV; band of opisthosomal conjunctival pleats indistinct; opisthosoma short, distinctly shorter than distance between anterior margin of coxa III and posterior margin of coxa IV; opisthosomal venter entire, bearing a single pair of setae.

Legs. Well developed and long, margins of segments often with well sclerotized areas of varying thickness; leg I four-segmented, distinctly wider than leg II and (excluding pretarsus) about as long; tibiotarsus I subelliptical, distinctly wider than other segments of leg; large, rounded sclerotized spot near outer margin of tibiotarsus I present midway between base and claw, this spot appearing internal rather than on dorsal surface; claw I single, stout, dilated basally, sessile, sometimes deformed, furnished with a stout, spine-like thumb, or thumb vestigial; trochanter I with two or three setae, seta *c* aciculate or absent, if present not reaching tibiotarsal sensory spot; trochanter II with three setae, femurogenu II with one or three; trochanter III with one or two setae, femurogenu III with one or two; tarsus II with five or six setae and a sensory peg, tarsus III with five setae; solenidium of tarsus II in basal one-half; solenidia of tibiae II and III lacking; pretarsi of legs II to IV elongate, nearly as long as tarsi; claws II to IV lacking, pulvilli II to IV well developed; coxa III long, triangular; coxa IV subcordate, distinctly mesad of coxa III; femurogenu IV with one seta, tarsus IV moderately long, tapering evenly, ratio of femurogenu IV to tarsus IV approximately 1:2.2 to 1:3.1.

DESCRIPTION OF GRAVID FEMALE.[13] Gnathosoma as described for non-gravid female but entire hysterosoma becoming greatly physogastric, globular.

DESCRIPTION OF MALE.[13] Length, similar to female; more angulate posteriorly than female and flattened dorsoventrally in life; opisthosoma not greatly modified to form connate or trapezoidal copulatory structure.

Gnathosoma. Reduced but present, hidden within propodosoma.

Hysterosoma. Venter. Apodemes III, IV, and V well developed, the first two nearly complete medially; opisthosoma bearing large, subcircular "genital plate," this with two pairs of "minute suckers"; apicoventrally, a pair of long setae and "another pair of suckers."

Legs. All legs five-segmented, legs II to IV shorter and stouter than those of female; tarsus I less incrassate, claw I smaller than in female; legs IV not tonglike or greatly modified for clasping, similar to legs III but distinctly shorter.

HABITS. Information is available only on the habits of *A. tribolii.* This species is found upon the bodies of *Tribolium confusum* Duval and other grain-inhabiting forms, principally beneath the elytra. In beetle cultures nearly every specimen may become infested with as many as thirty but more commonly ten to twelve female mites. Newstead and Duvall state that they "appear to be able to attack their hosts where the cuticle is thin between the joints, but most of them . . . where the large area of soft cuticle . . . offers little resistance to their minute, piercing and sucking jaws." In referring to a closely related form, *Paracarophenax dermestidarum,* Rack (1959), states that a similar mite-adult beetle association is purely phoretic. Since Newstead and Duvall failed to find gravid females upon the adult beetles, and since they report that the presence of the mites did not harm the adult host, it is probable that the same situation obtains in *A. tribolii.*

Phoretic females drop from the host beetle during the latter's oviposition and seek out an egg. Attaching to it, they begin to suck out its contents, resulting in its collapse. As they feed, physogastry commences, the entire female hysterosoma rapidly becoming enlarged and spherical, finally reaching 250 to 300μ in diameter. As enlargement progresses, the capability of the female to move is lost. Newstead and Duvall, referring to the female, state that "on the third day (after attachment to the egg) she dies and the young females emerge through a hole which corresponds in position to the genital orifice but which they enlarge for themselves." As in *Pyemotes* and *Trochometridium* the definitive immature stages are thus lost and the preimaginal period greatly shortened. The number of young varies from four to fifteen, depending upon the size of the physogastric mother. One of these is usually a male. Newstead and Duvall report several instances in which a male was lacking but never found more than a single male. Presumably mating occurs within the body of the mother before hysterosomal breakdown and accompanying birth since the male is found (usually dead) only within or immediately outside of the maternal body.

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[13] Specimens of these stages not seen, information taken from original description of *A. tribolii* N. and D. Quotations are from original description to which the reader is referred for more detail.

It was found that the newly born females did not immediately parasitize eggs offered to them, a fact which led Newstead and Duvall to infer that a conditioning period upon the adult beetle is necessary for "proper development." The fate of young females attaching themselves to males or to very old female beetles is not known, although Newstead and Duvall report that many finally perish upon the beetles.

SPECIMENS EXAMINED. Three species, including *tribolii,* from many parts of the United States, and India, taken from the following situations and hosts: rye mill, waste mill material, debris in nest of *Colaptes cafer* (Gmelin) (Aves, Piciformes), *Tribolium confusum* Duval, *Gnathocerus cornutus* (Fabricius), *Latheticus oryzae* Waterh., *Cryptolestes ferrugineus* (Steph.), (all Coleoptera).

Adactylidium, new genus

(Figs. 48-50)

Type, *Adactylidium beeri,* new species.

This genus includes *A. nicolae* (Krczal) and three previously undescribed species taken from various Thysanoptera in Michigan, New York, Florida, and Colombia (S. A.). Morphologically, it is most closely related to *Acarophenax,* but differs in that it lacks claws I, in that apodemes II are weakly arcuate and join the anterior median apodeme at an angle of nearly 90 degrees, because apodemes III are complete medially, and in exhibiting a reduced number of setae on certain structures (anterior ventral plate with one or two pairs, posterior ventral plate with only four pairs, tarsus II with five setae plus solenidium, tarsus III with four).

Of all the Acarophenacinae, members of this genus are alone in their association with insects other than beetles. As with other members of the subfamily, the species seem to be parasites of their hosts. Only the young, non-gravid females are known.

DIAGNOSIS. Females are distinct from those of all other genera in the family in possessing the following combination of characters: small size (length, 140 to 170μ), oval; leg I four-segmented, claws lacking on all legs; anterior ventral plate with one or two pairs of setae; pseudostigmata lacking.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 145 to 170μ; width, approximately 90 to 110μ; width between anterior sternocoxal condyles of coxa III approximately 44 to 68μ; hysterosoma oval, its posterior margin usually narrowly rounded; dorsum with or without coarse punctae.

Gnathosoma. Outlines indistinct, completely enclosed within propodosoma, not visible in dorsal aspect; palps fused, indistinct; setae of gnathosomal region reduced to one pair or none, if present, then directed anteriorly or anteroventrally; chelicera recurved, stout and needlelike, or stout basally and becoming indistinct apically; elongate, spindle-shaped pharyngeal-esophageal pump distinct or not, if distinct then extending posteriorly to anterior-mesal portions of coxa II, salivary ducts usually distinct dorsal to this pump.

Propodosoma. Dorsum. Broadly trapezoidal, anterior margin indistinct but probably continuing ventrad to completely or nearly completely envelop gnathosoma anteriorly; posterior margin overlapping first hysterosomal segment; U-shaped apodemes of arcula prominent, continuous anteriorly with peritremes; peritremes in "shoulders," circular, directed anteriorly or anteroventrally, bounding gnathosoma laterally; internal atria usually prominent, drop-shaped; pseudostigmata lacking; two or three pairs of propodosomal setae, anterior pair, if present, tiny, often indistinct, arising mesad of peritremes and appearing to be on gnathosoma. *Venter.* Anterior ventral plate probably with two pairs of setae, anterior pair sometimes not visible; coxa I as seen in ventral aspect attached obliquely to longitudinal axis of body; apodemes II strong, arcuate, complete medially or nearly so, making nearly a right angle with anterior median apodeme at point of intersection; anterior median apodeme well developed, its anterior portion appearing to extend into gnathosomal region; posterior marginal apodemes well defined, incomplete medially; pleated conjunctival band present dorsally between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment entire, overlapped anteriorly by propodosoma, bearing two pairs of setae; fourth segment with two pairs of setae, fifth segment much reduced, lacking setae, completely enclosed dorsally and laterally by fourth, usually visible only ventrally as an arcuate line; vulva apical. *Venter.* Posterior ventral plate entire, bearing four pairs of setae, external presternals and one pair of poststernals missing; hind margin of posterior ventral plate straight (could not be determined for one species); first axillary moderately mesad of anterior condyles of third coxa; second axillary seta arising from or slightly behind apodeme IV, well mesad of anterior sternocoxal condyle III; external presternal and internal poststernal setae lacking; apodemes III well developed, complete, arcuate, curving into posterior median apodeme; apodemes IV strong, slightly arcuate, incomplete medially, arising at anterior condyles of coxae IV, in general paralleling apodemes III; apodemes V absent, an integumental fold between the posteromesal margins of coxae IV sometimes distinct and appearing apodeme-like; posterior median apodeme weakly to strongly developed, complete or intermittent, extending well behind line drawn between anterior sternocoxal condyles of coxae IV; band of opisthosomal conjunctival pleats well developed, usually distinctly visible beneath opisthosomal venter; opisthosoma short, distinctly shorter than distance between anterior margin of coxa III and posterior margin of coxa IV; opisthosomal venter bearing a single pair of setae, its posterior margin entire or deeply cleft.

Legs. Well developed, of moderate length, margins of segments often with well sclerotized area of varying thickness; leg I four-segmented, distinctly narrower than leg II; tibiotarsus I elongate, sinuate or subrectangulate, not wider than other segments of leg; mediolateral sclerotized area near outer margin of tibiotarsus I lacking; claw I lacking; most basal seta of tibiotarsus I short, modified bladelike or clavate; trochanter I with three small setae, seta *c* unmodified, not reaching base of tibiotarsus I; trochanter II with three setae, femurogenu II with three; trochanter III with two setae, femurogenu III with two; solenidia of tibiae II and III lacking; tarsus II with five setae and a solenidium; tarsus III with four setae (one of these setae on tarsus II and two setae on tarsus IV arising at base of pretarsus, difficult to see); pretarsi II to IV moderately long, excluding pulvilli about half as long as tarsi; claws II to IV lacking, pulvilli well developed; coxa III long-triangular; coxa IV subcordate or short-triangular, not distinctly mesad of coxa III; femurogenu IV with one seta; tarsus IV about as long as III, tapering evenly; ratio of femurogenu IV to tarsus IV about 1:2.5 to 1:3.0; tarsus IV bearing one greatly elongate flagellate seta.

HABITS. No information concerning the habits of these forms is known. On morphological and phylogenetic grounds one may infer that they are parasites, probably either of the eggs or other stages, of various species of thrips, and that the females become greatly physogastric when gravid.

SPECIMENS EXAMINED. In addition to the types species, the following are known: *Species No. 1;* COLOMBIA: Intercepted at Washington, D. C., 5 ♀ ♀ from thrips on *Cattleya* sp. *Species No. 2;* FLORIDA: Welaka, 1 ♀ on *Elaphrothrips tuberculatus* (Hood);[14] NEW YORK: *Ithaca,* 3 ♀ ♀ on *Megalothrips spinosus* [14] Hood.

Adactylidium beeri,[15] new species

DIAGNOSIS. Very close to *A. nicolae* (Krczal), differing chiefly in that the single clavate solenidium of tibiotarsus I is in the apical half of the segment, in that the anterior setae of the anterior ventral plate (see Krczal, 1959b, p. 554) are not visible and perhaps lacking, and because the setae of segment III are subequally spaced.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 129μ (128-142, $\bar{X} = 132.16$); width, 89μ (89-96); distance between anterior sternocoxal condyles of coxae III, 44μ (44-46, $\bar{X} = 45.00$); body broadly oval.

Gnathosoma. Chelicerae stoutly aciculate, converging posteriorly, then recurved abruptly anteriorly to enter buccal cavity; anterior setae of gnathosomal region lacking.

Propodosoma. Dorsum. Dorsal propodosomal plate not coarsely punctate, extending posteriorly distinctly beyond line drawn between posterior margins of coxal foramina II; both pairs of pseudostigmatals nude, finely flagellate, the inner pair approximately 15μ anteromesad of the lateral pair; distance between inner pseudostigmatals 37μ (37-39); internal U-shaped apodemes of arcula bandlike; peritremes opening anterolaterally, not or only slightly directed ventrad. *Venter.* Apodemes II rather evenly and shallowly arcuate, complete medially; ventral setae I not visible, ventrals II short, nude, flagellate.

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[14] Det. J. D. Hood, Cornell University, Ithaca, N. Y.

[15] Named for Dr. Robert E. Beer, The University of Kansas.

Hysterosoma. Dorsum. Integument not coarsely punctate; setae of terga I to III long, nude, finely flagellate,[16] setae of tergum IV short, bladelike; dorsals I less than diameter of areolus anterior to laterals, approximately 16 to 21μ long, 37μ (37-43, $\bar{X} = 40.80$) apart; laterals I about as long as dorsals I, nearly twice as close to respective dorsals as dorsals to each other; dorsals II subequal to dorsals I in length, 52μ (48-54, $\bar{X} = 52.00$) apart; all setae of third tergum similar to those of dorsals I and II in length, dorsals III 17μ (17-22, $\bar{X} = 19.00$) apart, laterals about two areolar diameters behind line drawn through their areoli, and well laterad of them; setae of tergum IV terminal, arising posteroventrally, directed posteriorly and posterolaterally, dorsals and laterals subequal in length and shape, seven to eight μ long, spaced subequally across segment or nearly so. *Venter.* Apodemes III stout, broadly arcuate; all sternal setae short, approximately eight to fourteen μ, nude, flagellate; posterior margin of posterior ventral plate not or shallowly emarginate; internal presternals arising approximately eight μ laterad of posterior median apodeme, poststernals slightly more mesad; opisthosomal sternals nude, flagellate, short, approximately seven to eleven μ, on longitudinal line with internal presternals; posterior margin of opisthosomal sternum deeply emarginate.

Legs (all measurements in μ). *Length.* Leg I, 33 (32-34, $\bar{X} = 33.00$); leg II, 46 (46-47, $\bar{X} = 46.33$); leg III, 50 (47-52, $\bar{X} = 49.66$); leg IV, 46 (46-52, $\bar{X} = 48.50$). *Width.* Leg I, 8 (7-8, $\bar{X} = 7.83$); leg II, 13 (10-13, $\bar{X} = 11.66$); leg III, 9 (8-9, $\bar{X} = 8.83$); leg IV, 8 (8-9, $\bar{X} = 8.16$). *Segment lengths.* Tr I, 9 (8-10, $\bar{X} = 9.00$); tita I, 19 (18-20, $\bar{X} = 18.33$); tr II, 14 (14-15, $\bar{X} = 14.83$); ta II, 18 (15-19, $\bar{X} = 17.00$); ti III, 9 ($\bar{X} = 9.00$); ta III 19 (18-19, $\bar{X} = 18.50$); cx IV,[17] 14 (13-17, $\bar{X} = 14.50$); tr IV, 15 (15-19, $\bar{X} = 16.66$); fege IV, 5 (5-6, $\bar{X} = 5.20$); ta IV 18 (18-19, $\bar{X} = 18.83$). *Setation.* Leg I: cx 0T, tr 3T, fege 4T, tita 11T + 5S; leg II: cx 0T, tr 3T, fege 3T, ti 4T, ta 5T + 1S; leg III: cx 0T, tr 2T, fege 1T, ti 4T, ta 4T; leg IV: cx 0T, tr 1T, fege 1T, ti 4T, ta (? 3T).[18]

Setae *c* and *d* of trochanter I short, setiform; tibiotarsus I subelliptical, not sinuate, its most basal seta short (often difficult to see) with one median clavate and four apical-subapical rodlike solenidia;

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[16] Because of the extreme fineness of the apices of these setae, it was not possible to determine their lengths with enough accuracy to give exact measurements. Approximations of their lengths are given instead.

[17] Measured between anterior and posterior sternocoxal condyles.

[18] Presence of apical setae not ascertained.

solenidium of tarsus II short and rodlike, as broad as base of broadest sensory seta of tarsus II.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and five female paratypes (nos. 1 to 5) from the University of Michigan Biological Station, Cheboygan Co., Michigan, August 2, 1958, R. E. Beer, from thorax of Thysanoptera (host No. M-58-5).

TYPE REPOSITORIES. Holotype and three paratypes (nos. 1 to 3) in the Snow Entomological Museum at The University of Kansas; paratype no. 4 in the U. S. National Museum; paratype no. 5 to the Zoologisches Institut, Universität Erlangen, Erlangen, Germany.

Pygmephorinae, new subfamily

DESCRIPTION OF NON-GRAVID FEMALE. Small to moderately sized mites, 150 to 600μ long; shape variable, usually elliptical to oval, rarely circular; posterior margin of hysterosoma evenly rounded or truncate; integument usually moderately, often heavily sclerotized, integumental "pebblings" or other engravings present or absent.

Gnathosoma. Always free, directed anteroventrally, ventrally, or posteroventrally, never largely or completely hidden within the propodosoma; palps free and movable; chelicerae usually small, indistinct, rarely enlarged and distinct.

Propodosoma. Dorsum. Always entire, pseudostigmata present; one to three pairs of dorsal propodosomal setae; anterior margin of first hysterosomal tergum usually overlapping propodosoma to varying degrees, occasionally entirely; esophageal "finned structures" present or absent. *Venter.* Anterior ventral plate with four to six pairs of setae.

Hysterosoma. Four to five visible segments, segment V often enclosed dorsally but never posteroventrally by tergum IV; segment V with two or three pairs of setae; posterior portion of vaginal wall sclerotized or enclosed in enlarged, elliptical to globose pumplike structures or not; at least one genital sclerite present, shape variable; opisthosoma not distinctly shorter than distance between anterior margin of coxa III and posterior margin of coxa IV, or if so, then body circular; opisthosomal venter lacking setae.

Legs. Leg I four-segmented; coxa I, as seen from beneath, articulated at a right angle to longitudinal axis of body or (usually) distinctly obliquely; claws sometimes absent on leg I or leg IV, or both, always present on II and III; trochanter I with three to four setae, seta *c* setiform, stout and rodlike, spatulate apically, or membranous and blade or hooklike; pinnacula present or absent; coxa IV quadrate to rectangulate.

Key to the Tribes of the Subfamily Pygmephorinae (Females)

1(*a*). With three pairs of propodosomal dorsals; four to six pairs of anterior sternals; trochanter I with three or four setae; claw I, if present, sessile *Pygmephorini*, new tribe, p. 148

1(*b*). With one or two pairs of propodosomal dorsals; four pairs of anterior sternals; trochanter I with three setae; claw I, if present, usually more or less pedicellate 2

2(*a*). Seta *c* of trochanter I setiform; one pair of propodosomal dorsals, or, if two, second pair not visible except under very high magnification; hysterosomal segment V usually with two pairs of setae *Microdispini*, new tribe, p. 164

2(*b*). Seta *c* of trochanter I semimembranous, bladelike, the apical portion usually proflexed; one (rarely) or two pairs of propodosomal dorsals; segment V usually with three pairs of setae *Neopygmephorini*, new tribe, p. 196

Pygmephorini, new tribe

This tribe includes three genera: *Pediculaster* Vitzthum, 1931, *Pygmephorus* Kramer, 1877, and *Microdispodides* Vitzthum, 1914. Its members are considered to be closely related to and perhaps directly descended from members of the genus *Siteroptes*. Females are easily distinguished from those of the remaining two tribes of the Pygmephorinae in possessing three pairs of propodosomal dorsals as well as in other characters outlined in the description below.

DESCRIPTION OF NON-GRAVID FEMALE. Striae absent on most lateral portions of posterior ventral plate.

Gnathosoma. Quadrate or longer than wide; palps never greatly elongate, fitted for piercing.

Propodosoma. Dorsum. With three pairs of setae; peritremes dorsal, contiguous or widely separated, cylindrical, guttate, or circular; two esophageal "finned" structures present. *Venter.* Anterior ventral plate with four to (usually) six pairs of setae; external ventrals I furcate or not.

Hysterosoma. Dorsum. First hysterosomal tergum never covering more than posterior half of propodosoma; segment V with three pairs of setae; posterior portion of vaginal wall often enclosed in elliptical or globose pumplike structure; posterior genital sclerite usually elongate, never broadly triangular or flaplike. *Venter.* Apodemes V present or absent.

Legs. Leg I articulated obliquely or at a right angle to the longitudinal axis of body; size variable; claw I rarely absent, if present, sessile; mediolateral sclerotized area of tibiotarsus I present or absent; trochanter I with three or (usually) four setae, seta *c* short, membranous, bladelike, often hooked, or elongate, stout-setiform, blunt or spatulate apically; pinnacula of tibiotarsus I absent.

Key to the Genera of the Tribe Pygmephorini (Females)

1(*a*). Seta *c* of trochanter I straight and stout, obtuse or spatulate apically *Pediculaster*, p. 149
1(*b*). Seta *c* of trochanter I short, semimembranous, more or less bladelike and proflexed apically 2
2(*a*). Claws I and IV lacking; dorsum of body with scalelike integumental engravings .... *Microdispodides*, p. 159
2(*b*). Claws I and IV present; dorsum of body lacking scalelike integumental engravings .... *Pygmephorus*, p. 156

Pediculaster Vitzthum

This genus is closely related to certain *Siteroptes* and *Pygmephorus.* It resembles the former in general body conformation, in that coxae I arise nearly at a right angle to the longitudinal axis of the body, in possessing three pairs of propodosomal dorsals, in that trochanter I bears four setae, and in that the stigmata are guttate or elliptical and contiguous or nearly so. It differs from *Siteroptes* and resembles *Pygmephorus* in that tibia and tarsus I are fused, in that claw I is stout and sessile, and because claws II and III are cleft and dilated basally. It also differs from *Siteroptes* in that many, if not all, forms are phoretic upon various Diptera.

Specific relationships within the group are seemingly complex. The author has examined at least seven species.

Only the females of *Pediculaster* are known.

DIAGNOSIS. Females are distinguished from those of other genera in the family by the following combination of characters: leg I with four segments, claw I sessile and often deformed, seta *c* of trochanter I stout and straight, blunt or spatulate apically, propodosoma with three pairs of dorsals.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 200 to 480µ; width, 95 to 290µ; width between anterior sternocoxal condyles of leg III 65 to 240µ; hysterosoma broadly to narrowly elliptical; integument pale and weakly sclerotized to yellow-brown and heavily sclerotized, lacking scalelike or "pebbled" integumental engravings; body usually with large punctae.

Gnathosoma. Normally directed ventrally, shape quadrate to rectangular; palps with large apical teeth; chelicerae distinct, aciculate; esophageal-pharyngeal pump absent but esophageal "finned" structures usually distinct.

Propodosoma. Dorsum. Distinct dorsal sclerite present, enlarged posteriorly, rounded or falcate at points of greatest width; anterior portion prolonged hoodlike over gnathosoma, circumgnathosomal foramen anteroventrad, its lateral margins only moderately sclerotized; posterior margin covered by anterior margin of first hysterosomal tergum or these two sclerites meeting but not overlapping; pseudostigmata located in posterior third to fifth of dorsal plate; three pairs of propodosomal dorsals; peritremes dorsal and median, usually contiguous or nearly so, diverging, guttate, campanulate, or elliptical, often septate; two esophageal "finned" structures visible. *Venter.* Anterior ventral plate with four to (usually) six pairs of setae, if five pairs then ventrites II with only two pairs; external ventrals I not bifurcate; ventral medials II, if present, usually much closer to externals II than to internals II; coxa I articulating at nearly a right angle to the longitudinal axis of body or (rarely) coxa I articulating obliquely; apodemes II distinct, straight or bending posteriorly near anterior median suture, usually complete, if straight then making angle of more than 45 degrees with anterior median apodeme; secondary transverse suture absent; posterior marginal apodemes well developed; pleated conjunctival band between propodosoma and hysterosoma not distinct.

Hysterosoma. Dorsum. Fifth dorsal segment well developed but usually completely enclosed by fourth in dorsal aspect; vulva apicoventral; vagina heavily sclerotized apically or not, surrounded by globose to elliptical pumplike enlargements or not; anterior genital sclerite separable from other genital sclerites or not, but if so, then its anteriormost point well posterior to line drawn between the posterior margins of coxae IV; posterior genital sclerite variable in shape but not broadly flaplike. *Venter.* Posterior ventral plate entire or (rarely) divided by a single transverse line between the centers of coxae III, the two plates thus formed contiguous and not overlapping; posterior ventral plate with four to six pairs of setae; hind margin of posterior ventral plate tripartite, trilobed, or straight; second axillaries present or absent; external presternals well behind and usually barely laterad of internal presternals, arising from or only slightly anterior to apodemes IV; position of external poststernals variable; apodemes III and IV well developed or (rarely) lacking, if present at least apodemes III meeting posterior median apodeme; apodemes III bending posteriorly at the sides to join anterior sternocoxal condyles III; apodemes IV arising laterally between coxae III and IV, meeting posterior sternocoxal condyle of III; apodemes V present or absent, if present then joining posterior median apodeme; band of distinct opisthosomal conjunctival pleats lacking; opisthosoma long, always longer than distance between anterior margin of coxa III and posterior margin of coxa IV.

Legs. All legs well developed and bearing claws; leg I four-segmented, always distinctly wider and usually much longer than leg II; tibiotarsus I quadrate to rectangulate, tapering, not or barely wider than other segments of leg; pinnacula lacking; mediolateral sclerotized plate of tibiotarsus I absent or poorly developed; claw I stout, sessile, dilated basally or not, bearing thumb or not; trochanter I with four setae; seta *c* straight and stout, nude, not flagellate, bluntly pointed or spatulate apically, rarely reaching middle of femurogenu; tarsi II and III each bearing six tactiles; solenidia of tibiae II and III present; claws II and III simple or with cleft or basal dilation; claw IV simple, usually not much smaller than those of II and III; pulvilli II to IV trumpet-shaped, always longer than claw; coxa III triangular or subcordate in inner ventral aspect; coxa IV subquadrate to rectangulate, not constricted near base, not bulbose; tarsus IV short to moderately elongate, not evenly attenuate from base to apex; ratio of femurogenu IV to tarsus IV approximately 1:1.6 to 1:4.1. *Description of gravid female.* As above but entire hysterosoma becoming physogastric, globular.

Key to the Subgenera of *Pediculaster* (Females)

1(*a*). Posterior ventral plate entire............*Pediculaster sensu stricto,* p. 154
(*b*). Posterior ventral plate divided transversely between coxae III *Acarothorectes,* p. 151

Acarothorectes, new subgenus

(Figs. 54-56)

Type, *Pediculaster* (*Acarothorectes*) *curculionium,* new species.

This subgenus is established to accommodate a single species which differs markedly from the remaining forms within the genus. In addition to the morphological differences mentioned below, the type series was taken from the body of a curculionid, an unusual host for forms of *Pedicaster.*

DESCRIPTION OF NON-GRAVID FEMALE. Agrees with the description of the genus except for the following: hysterosoma narrowly elliptical, markedly elongate; integument moderately sclerotized, coarsely punctate.

Gnathosoma. Small, rectangulate.

Propodosoma. Dorsum. Dorsal sclerite elongate, with distinct median longitudinal keel from which arise the peritremes, pseudostigmata, stigmatal, and anterior pseudostigmatal setae; laterad of keel on each side, a concavity which receives the clavola of the pseudostigmata; peritremes campanulate, diverging nearly 180 degrees; esophageal "finned" structures characteristic, the anterior much larger and more conspicuous than the posterior, the fins much more distinct and thicker than those found in other members of the genus. *Venter.* Anterior ventral plate with five pairs of setae; coxa I articulating at nearly a right angle to longitudinal axis of body; apodemes II straight, incomplete medially; anterior median apodeme complete, becoming increasingly weaker posteriorly.

Hysterosoma. Dorsum. Vagina not heavily sclerotized apically, not surrounded by globose to elliptical pumplike enlargement, but a heavily sclerotized ringlike structure present. *Venter.* Posterior ventral plate divided by a single transverse line between the centers of coxae III, the two plates thus formed contiguous and not overlapping; posterior ventral plate with but four pairs of setae; hind margin of ventral plate with single, large median lobe; internal presternals displaced anteriorly, arising at least two setal lengths anterior to external presternals, well mesad of latter; external poststernals arising less than three areolar widths behind line drawn between posterior margins of coxal foramina IV; apodemes III to V absent; posterior median apodeme short, weak.

Legs. Leg I much wider and distinctly shorter than leg II; tibiotarsus I quadrate, tapering, not wider than femurogenu I; mediolateral sclerotized plate absent; claw I with irregular basal dilation, thumb small; seta *c* spatulate apically;[19] claws II and III with elongate ventral thickenings which terminate subapically, possibly in a tooth; claws IV simple, stouter than claws II and III; pretarsus IV nearly one third total length of tarsus IV; coxa IV short, subquadrate, slightly wider than long; tarsus IV quadrate, ratio of femurogenu IV to tarsus IV approximately 1:1.6.

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[19] In all mounted specimens of the type series, legs I are twisted so that claw I turns outward rather than inward, resulting in a mesal displacement of certain setae including those of the trochanter. The normal position of legs I therefore probably differs somewhat from closely related forms.

HABITS. Nothing is known of the habits of this mite.

Pediculaster (*Acarothorestes*) *curculionium,* new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 229μ (223-290, $\bar{X} = 249.67$); width, 96μ (83-110, $\bar{X} = 100.17$); distance between anterior sternocoxal condyles of coxae III, 59μ (58-79, $\bar{X} = 65.17$); punctae covering entire body, including tips of tarsi.

Gnathosoma. Small, length[20] (19-26); width[20] (15-17); external dorsals lacking; solenidium 2 small, slightly shorter than solenidium 1, not capitate; distance between first and second palpal setae about 5μ.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets 9μ (9-11, $\bar{X} = 10.66$); all propodosomal setae stout, spiculate; stigmatals only three to five μ apart, approximately 25 to 30μ long, subequal in size to posterior pseudostigmatals; anterior pseudostigmatals smaller, arising about one areolar diameter posterolateral of stigmatals; posterior pseudostigmatals arising nearly directly laterad of pseudostigmata, about 25 to 30μ apart. *Venter.* Five pairs of short, nude, flagellate setae, the two pairs on ventrites II subequal in size, approximately 16 to 21μ, distinctly longer than setae of ventrites I; internal ventrals II only slightly closer to external ventrals II than to anterior median apodeme; apodemes II straight, strongest laterally, becoming progressively weaker toward the center, incomplete medially, making angle of about 60 degrees with anterior median apodeme.

Hysterosoma. Dorsum. All dorsal setae except laterals III, dorsals IV, and all setae of segment V stout, spiculate, their apices blunt or bluntly pointed; dorsals I (21-25, $\bar{X} = 23.60$) long, 29μ (28-31, $\bar{X} = 29.67$) apart; laterals I about two to four areolar widths anterior to line drawn between dorsals I, 28μ (28-33, $\bar{X} = 29.50$) long, distinctly closer to respective dorsals than dorsals to each other; dorsals II 22μ (17-23, $\bar{X} = 21.00$) long, 42μ (41-45, $\bar{X} = 42.17$) apart; dorsals III 25μ (23-26, $\bar{X} = 24.83$) long, as far apart as dorsals II; laterals III bristlelike, 7μ (5-7, $\bar{X} = 6.50$) long, arising about one dorsal areolar width laterad of respective dorsals; dorsals IV similar to laterals III in size and conformation, well behind and only slightly mesad of laterals IV, 26μ (25-31, $\bar{X} = 27.67$) apart; laterals IV 25μ (13-25, $\bar{X} = 15.83$) long; internal and external caudals I subequal in size, bristlelike, about four μ long, external caudals II bristlelike but longer, about 16μ. *Venter.* All setae of posterior ventral plate short, nude, flagellate, approximately 10 to 15μ long; internal presternals nearly the length of coxa III anterior to coxa III.

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[20] These measurements of the holotype not possible.

Legs (all measurements in μ). *Length.* Leg I, 56 (55-63, $\bar{X} = 58.50$); leg II, 75 (74-80, $\bar{X} = 75.67$); leg III, 74 (74-80, $\bar{X} = 76.50$); leg IV, 58 (58-68, $\bar{X} = 61.00$). *Width.* Leg I, 23 (16-24, $\bar{X} = 21.83$); leg II, 14 (11-15, $\bar{X} = 13.16$); leg III, 11 (8-12, $\bar{X} = 10.17$); leg IV, 17 (14-19, $\bar{X} = 16.17$). *Segment lengths.* Tr I, 25 (24-28, $\bar{X} = 25.17$); tita I, 23 (23-26, $\bar{X} = 24.83$); tr II, 19 (18-20, $\bar{X} = 18.67$); ta II, 31 (31-35, $\bar{X} = 32.56$); ti III, 14 (14-17, $\bar{X} = 15.00$); ta III, 30 (28-33, $\bar{X} = 30.33$); cx IV, 18 (18-22, $\bar{X} = 19.33$); tr IV, 14 (14-19, $\bar{X} = 16.50$); fege IV, 9 (8-9, $\bar{X} = 8.67$); ta IV, 14 (14-17, $\bar{X} = 15.00$). *Setation.* Leg I: cx 0T, tr 3T + 1 specialized, fege 4T, tita 12T + 9S; leg II: cx 1T, tr 3T, fege 1T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Tibiotarsus I with five rodlike and four short, stout, solenidia, the latter all in apical third of the segment; claw I sharply bent, a conspicuous tubercle on its inner margin; thumb stout but short; solenidia of tibiae II and III small, clavate, sub-basal; solenidium of tarsus II also sub-basal, short and stout, approximately 4.5 x 3μ; tarsi II and III each constricted suddenly into elongate pedicel nearly one-third total length of tarsus; solenidium of tibia IV short, clavate, sub-basal; tarsus IV with three greatly elongated apical setae, the external distinctly longer than the two internals.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and five female paratypes (nos. 1 to 5) from Palmira-Valle, Colombia (Let.), May 14, 1946, from B. Losada S., on *Copturomimus* sp. (Curculionidae).

TYPE REPOSITORIES. Holotype and three paratypes (nos. 2, 3, 5) in the U. S. National Museum, Washington, D. C. One paratype (no. 1) in the Snow Entomological Museum, The University of Kansas. One paratype (no. 4) in the Zoologisches Institut, Universität Erlangen, Erlangen, Germany.

Subgenus *Pediculaster, sensu stricto*

(Figs. 57-58)

Pediculaster Vitzthum, 1931, Memoíres du Musée Royal D'Histoire Naturelle De Belgique, Hors Serie—Résultats Scientifiques du Voyage aux Indes Orientales Néerlandaises, 3 (5):36, Acarina. Type, *Pygmephorus mesembrinae* R. Canestrini, 1880, by original designation.

DESCRIPTION OF NON-GRAVID FEMALE. *Propodosoma. Dorsum.* "Fins" of esophageal "finned" structure fine, often difficult to see.

Hysterosoma. Venter. Posterior ventral plate entire, not divided transversely between coxae III; posterior ventral plate with five or six pairs of setae; apodemes III and IV always present.

Species thought to belong in *Pediculaster*, *s. str.*:

americanus (Banks, 1905) (*Pygmephorus*)
americanus var. *socotrensis* (Hirst, 1921) (*Pygmephorus*)
heliocopridis (Vitzthum, 1931) (*Pediculoides*)
manicatus (Berlese, 1904) (*Pygmephorus*)
mesembrinae (Canestrini, 1880) (*Pygmephorus*)
?*wichmanni* (Vitzthum, 1923) (*Pediculoides*)

A comparison of Hirst's (1921) drawing of *P. americanus* with the type of that species shows numerous differences in setation and the two are quite possibly distinct.

HABITS. Little is known of the habits of the members of this subgenus. Vitzthum (1941), states that the mated but non-gravid females of *P. mesembrinae* ride upon adult flies and drop off at the oviposition sites where they attack the developing larvae. The same author states that the same species has been shown to attack the gall midge, *Cecidomyia saliciperda* Dut. in the same manner.

According to the above author, female mites identified as *P. mesembrinae* have been taken from the following flies in Europe: *Mesembrina mystacea* L., *Musca domestica* L., *Stomoxys calcitrans* (L.), *Siphona irritans* (L.), *Strathiomys* (*sic!*) sp., and various Borboridae. The same author described *P. heliocopridis* from an Asian *Heliocopris*. In the United States, Banks described *P. americanus* from *Musca domestica* L. Other host records may be obtained from the list below.

SPECIMENS EXAMINED. *Pediculaster americanus* Banks, Lectotype female (here designated) and four syntype females from Washington, D. C., Jan. 30, 1915 (U.S. N. M. No. 6984). In addition, eight unidentified species from many localities in the United States and from Mexico (Baja California) and from Haiti, from the following situations or hosts: *Musca domestica* L., anthomyiid fly (prob. *Fannia*), thorax of "Muscidae," thorax of Ephydridae, thorax of *Leptocera* (Diptera, Borboridae), from "fly," from *Diatraea* (Lepidoptera) in rearing cage, peach orchard soil, in manure, on commercial mushrooms, on leaves of *Azalea* sp., treehole of *Fagus* *grandifolia* Ehrh., nest of *Peromyscus truei* (Shufeldt), nest of *Neotoma albigula* Hartley, ground litter in forest of roble and pines (Baja California).

Pygmephorus Kramer

(Figs. 59-60)

Pygmephorus Kramer, 1877, Archiv für Naturgeschichte, 43(1):248-259. Type, *Pygmephorus spinosus* Kramer, by original designation.

This genus was erected to contain a single species taken from a mole. Beginning with Canestrini (1880), but due chiefly to the various works of Berlese and Oudemans, the limits of the genus became increasingly broad. Krczal (1958, 1959b) includes all those forms comprising the present author's subfamily Pygmephorinae except that he has retained *Microdispodides* Vitzthum, 1914. In this paper the genus is restricted to those forms defined in the diagnosis below.

Members of the genus are most closely related to those of *Pediculaster* and *Microdispodides*. They differ from the former in the shape and size of leg I, the shape and size of seta *c* of trochanter I, the conformation of the ventral apodemes, the shape and position of the peritremes, and other characters. They differ from the latter in the character of leg I, in the type of integumental engraving, and in other characters.

Species of *Pygmephorus* are known to occur in Europe, South Africa, and North and South America. Several forms occurring on mammals have been found in Iceland, Greenland, and Point Barrow, Alaska. Only the females are known.

DIAGNOSIS. Females separable from those of all other genera in the family by the following combination of characters: three pairs of propodosomal dorsals [Kramer, in his original description and illustrations, indicated *spinosus* to have but two pairs of propodosomal dorsals. Although the author has not seen the type of *spinosus*, an inspection of many specimens believed to be that species (or relatives not separable from it by the original description) showed all to possess three pairs of propodosomal dorsals. The author therefore concludes that Kramer was either unable to observe the third pair or that *spinosus* was described from abnormal specimens. It should be further pointed out that because of its wide distribution and host range, it is quite possible that *spinosus*, as now understood, will prove to be several closely related species]; leg I four-segmented; seta *c* of trochanter I short, semimembranous, bladelike, the apical portion proflexed; claw I large, sessile.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 110 to 520μ; width, 75 to 220μ; width between anterior sternocoxal condyles of coxae III 55 to 170μ; hysterosoma oval to elliptical, its posterior margin broadly rounded or truncate; integument often with large, deep punctae, appearing "pebbled."

Gnathosoma. District, squarish or slightly longer than wide, normally directed anteroventrally or ventrally; palps free, distinct, with one or more apical teeth; chelicerae tiny, indistinct; large, ventral esophageal-pharyngeal pump absent, esophagus usually plainly visible as a simple tube.

Propodosoma. Dorsum. Inversely T-shaped, often greatly elongated behind pseudostigmata, anterior portion prolonged hoodlike over gnathosoma; margins of circumgnathosomal foramen heavily sclerotized, at least laterally, to form "collar" which encloses basal third to quarter of gnathosoma; posterior margin well covered by anterior margin of first hysterosomal tergum; peritremes widely separated, dorsal and circular, ovoid, or elongate troughlike and terminating anteriorly in propodosomal "shoulders"; esophageal "finned" structures distinct or not, if so then two in number, the anteriormost globose to subquadrate. *Venter.* Anterior ventral plate with four to six pairs of setae, if ventrites II with two pairs then internal ventrals about as close to anterior median apodeme as to external ventrals; ventral externals I forked or not; coxa I articulated at nearly a right angle to the longitudinal axis of body or distinctly obliquely; apodemes II strong, straight or weakly arcuate, complete medially; secondary transverse suture absent; anterior median apodeme very strong, complete; posterior marginal apodemes strong, complete; pleated conjunctival band indistinct between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment entire, its anterior margin overlapping posterior margin to posterior fourth of propodosoma; fifth segment well developed but usually completely enclosed by fourth in dorsal aspect, bearing three pairs of ventral or apicoventral setae; vulva apical or nearly so, vagina enclosed apically by a distinct, sclerotized, elliptical or globose enlargement, its shape dependent partly upon mount; posterior genital sclerite often globose, never triangular and flaplike; anterior genital sclerite distinctly posterior to line drawn between posterior margins of coxal foramina IV; median genital sclerite absent. *Venter.* Posterior ventral plate entire, its hind margin also entire; posterior ventral plate bearing six pairs of setae; external presternal well posterior to and scarcely laterad of internal presternal, arising from or not more than two areolar widths in front of apodemes IV; external poststernal present, varying in position; apodemes III weak, often intermittent, not bending posteriorly to join anterior sternocoxal condyles III; apodemes IV distinct only medially, extending about half way to coxae III, directed toward center of coxal foramen; apodemes V present or absent; posterior median apodeme distinct, arising from vicinity of internal presternals and extending posteriorly at least as far as second axillaries; band of opisthosomal conjunctival pleats present or absent; opisthosoma distinctly longer than distance between anterior margin of coxa III and posterior margin of coxa IV.

Legs. All legs well developed, bearing claws; leg I shorter and thicker than leg II; tibiotarsus I elliptical, quadrate, or subpentagonal, often enormously enlarged, always distinctly wider than other segments of leg; pinnacula present or not, if present then arising from median portion of ventral surface of segment; large, rounded, mediolateral sclerotized plate present on tibiotarsus I; claw I enormously developed, furnished with an equally well developed bladelike thumb which may have a single tooth along its inner margin; trochanter I with three or (usually) four setae, seta *c* short, bladelike, semimembranous, the apical portion often proflexed; solenidia of tibiae II and III present or absent; tarsus II with five to seven setae and a solenidium, tarsus III with five to seven setae; claws II to IV simple or (usually) with rounded basal dilations; pulvilli II to IV well developed; coxa III subtriangular or subcordate; coxa IV short-rectangulate to elongate and slightly bulbose basally; tarsus IV slightly to distinctly longer than tarsus III, tapering abruptly; ratio of femurogenu IV to tarsus IV 1:3.0 to 1:5.0.

Species thought to belong in *Pygmephorus:*

ceratophyi Krczal, 1959
crassipes Krczal, 1959
dominguezi Athias-Henriot, 1961
erlangensis Krczal, 1959
forcipatus Willmann, 1952
ignotus Krczal, 1959
islandicus Sellinck, 1940

karafiati (Krczal, 1959) (*Microdispodides*)
microti Krczal, 1959
soricis Krczal, 1959
stammeri Krczal, 1959
ursulae Krczal, 1959

HABITS. Little is known concerning the habits of the mites of this group. *P. spinosus* and its relatives are found in the nests and food caches and on the bodies of a variety of widely distributed small rodents and insectivores. The remaining forms are found in association with Coleoptera (Scarabaeidae, Buprestidae) or with trees. The possibility exists that the latter may more properly be associated with wood-inhabiting insects, at least during the phoretic period. Since the *P. spinosus* complex differs markedly from the other species of the genus in both structure and habitat, later research may prove it to deserve separate status. Females of the *spinosus* group become physogastric in the same manner as those of *Siteroptes*, the hysterosoma becoming ovoid rather than globose, however. The swelling may be less pronounced, the largest female seen by this author measuring approximately 700μ long, 400μ wide, and 550μ high.

SPECIMENS EXAMINED. At least five species from many parts of the eastern United States and Alaska, and from Canada, Germany, and Surinam, from the following situations or hosts: "mole," *Sorex araneus* L., S. *cinereus* Kerr, *Blarina brevicauda* (Say), *B. b. carolinensis* (Bachman), *Cryptotis* sp., *Microtus ochrogaster* (Wagner), *Peromyscus gossypinus* (LeConte), bumblebee nest in old lemming burrow, humus under log, under bark of dead tree, from cativo logs (Surinam), and from dung beetle.

Microdispodides Vitzthum

(Figs. 61-63)

Microdispodides Vitzthum, 1914, Zoologischer Anzeiger 44(7):315-328. Type, *Microdispodides wichmanni* Vitzthum, 1914, by original designation (= *Pediculoides amaniensis* Oudemans, 1912).

Previously known only from the type species, a second species of the genus is described herein. The genus stands closest morphologically to *Pygmephorus,* which it resembles in possessing three pairs of propodosomal dorsals, in having the peritremes well separated, in that apodemes II are straight or nearly so, because the vagina is encompassed apically within a sclerotized structure which is oval or elliptical in shape, and other characters. Its members may be separated from those of *Pygmephorus* by the shape of leg I and by the lack of claws on legs I and IV.

Members of the genus are known only from Africa [Cameroon and Tanganyika (German East Africa)] and Central America (Guatemala). They are phoretic upon beetles. Only the non-gravid females are known. *Diagnosis.* The non-gravid females are distinguished from those of all other genera in the family by the following combination of characters: three pairs of propodosomal dorsals and six pairs of propodosomal ventrals; seta *c* membranous and flaplike, proflexed apically; integument, at least in part, with scalelike engravings; leg IV clawless, pretarsus IV nearly as long as tarsus IV.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 135 to 235μ; width, 70 to 135μ; width between anterior condyles of coxa III approximately 90μ; hysterosoma oval, its posterior margin broadly rounded or truncate; body well sclerotized, portions of dorsal integument appearing scaled.

Gnathosoma. Squarish, normally directed anteroventrally or ventrally; chelicerae tiny, indistinct; ventral esophageal-pharyngeal pump absent; esophagus plainly visible as a simple tube.

Propodosoma. Dorsum. Irregularly trapezoidal, often elongate posteriorly behind pseudostigmata; anterior portion extending hoodlike over gnathosoma; circumgnathosomal foramen anteroventrad, its lateral margins only moderately sclerotized; posterior margin of propodosoma overlapping or weakly overlapped by first hysterosomal segment; three pairs of propodosomal setae; peritremes ("Augen" of Oudemans, 1915) widely separated, circular or guttate, opening anterodorsally, arising near anterolateral angles of propodosoma; esophageal "finned" structures paired, subequal, subglobose-rhomboidal. *Venter.* Anterior ventral plate with six pairs of setae; external ventrals I not furcate; coxa I articulated distinctly obliquely to longitudinal axis of body; apodemes II usually strong, complete, straight or barely sinuate; secondary transverse suture absent; anterior median apodeme distinct, complete or broken briefly in front of apodemes II; posterior marginal apodemes strong and complete; pleated conjunctival band between propodosoma and hysterosoma not visible.

Hysterosoma. Dorsum. First segment either overlapping or being overlapped by propodosoma, bearing two pairs of setae; fifth segment well developed but usually enclosed by fourth in dorsal aspect, bearing three pairs of apicoventral setae; vulva apical or nearly so; vagina surrounded by apical, sclerotized, elliptical, pumplike enlargement; three genital sclerotizations, the posterior semicircular in part, the anteriormost the largest, possessing a pair of lateral projections; anterior genital sclerite well posterior to line drawn between posterior margins of coxae IV. *Venter.* Posterior ventral plate entire, bearing six pairs of setae; hind margin of posterior ventral plate entire, broadly emarginate; external presternal well posterior to internal presternal and mesad or laterad of latter, arising well anterior to apodeme IV; external poststernals present, long, only slightly behind line drawn between posteromesal articulations of coxae IV; apodemes III indistinct or fragmentary; apodemes IV distinct only medially, extending one-quarter to one-third of distance to coxae III, or with additional fragments of apodemes present between medial portions and coxae III; apodemes IV directed toward centers of coxal foramina; apodemes V lacking; posterior median apodeme distinct, arising from vicinity of internal presternals and extending posteriorly to vicinity of second axillaries; band of opisthosomal conjunctival pleats not distinct if present; opisthosoma distinctly longer than distance between anterior margin of coxa III and posterior margin of coxa IV.

Legs. Leg I distinctly shorter and thinner than leg II; tibiotarsus I elongate-elliptical, as wide or narrower than other segments of leg; pinnacula lacking; large, rounded, mediolateral sclerotized area absent on tibiotarsus I; claw I lacking; trochanter I with four setae; seta *c* bladelike, semimembranous, its apical portion proflexed; solenidia of tibiae II and III present; tarsus II with six setae and solenidium, tarsus III with six setae; pretarsi II and III moderately elongate, about half length of respective tarsi, pretarsus IV more elongate, slightly longer than tarsus IV; claws II and III present and stout with rounded basal dilations, claws IV lacking; coxa III subcordate or short-triangular; coxa IV rectangulate, slightly constricted and bulbose basally; tarsus IV about as long as III (excluding pretarsi), subrectangulate; ratio of femurogenu IV to tarsus IV about 1:1.5. *Habits.* Nothing is known of the habits of these mites. *M. amaniensis* is known from the Cameroons and from German East Africa (Tanganyika) upon *Polygraphus congonus* Wichmann and *Platypus dispar* respectively, at least the former residing beneath the elytra. Both hosts are members of the Scolytoidea, the former belonging in the Scolytidae, the latter in the Platypodidae. *M. pholidotus* is known only from a Guatemalan species of *Metamasius* (Curculionidae-Calendrinae).

Key to the Females of *Microdispodides*

1(*a*). Small, 135 to 150μ; first axillary adjacent to anteromesal margin of coxal foramen III; Africa................*M. amaniensis* (Oudemans)

1(*b*). Larger, 210 to 240μ; first axillary two to three times its own length mesad of anteromesal margin of coxal foramen III; Central America *M. pholidotus*, new species, p. 162

Microdispodides pholidotus, new species

Diagnosis. In addition to the key characters listed above, *M. pholidotus* differs from *amaniensis* in that the external presternals are mesad of the internal presternals, the external poststernals do not nearly reach the hind margin of the body, and in various other characters.

Description of Non-gravid Female. Length, 223µ (212-239); width, 135µ (133-135); distance between anterior sternocoxal condyles III, 85µ (83-88); propodosomal dorsum with uniformly distributed, coarse, elongate punctae; discs of first three hysterosomal terga with bands of scalelike integumental engravings, broadest on first tergum; anterior three-quarters of tergum IV with dense, elongate punctae, appearing pilose; tergum V and venter of body nearly uniformly punctate, punctae distinctly smaller and rounder than those of propodosomal dorsum.

Gnathosoma. Quadrate, length[21] (25µ); width[21] (23-24µ); gnathosomal dorsals in transverse row, subequal in size; solenidium II large, barely capitate; solenidium I clavate, about four µ long; distance between first and second palpal setae about six µ.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets 47µ (45-47); all propodosomal dorsals stout, nude, short, posterior pseudostigmatals distinctly longer than others, 31µ (29-31), arising directly behind and close to external pseudostigmatal socket; anterior pseudostigmatals arising at a slightly greater distance directly anterior to above socket, shorter than others; stigmatals distinctly mesad of others, approximately 30µ apart. *Venter.* Internal ventrals I short, lanceolate, median and external ventrals I nude, flagellate, the three setae on each side arising in a straight line; setae of ventrites II linearly arranged as described for ventrites I, nude, flagellate, the externals longer than the others, subequal in size to externals I; internal and mesal ventrals II slightly mesad of internal and mesal ventrals I, externals II slightly laterad of externals I.

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[21] This measurement not possible from holotype.

Hysterosoma. Dorsum. Dorsal setae of first four segments stout, weakly lanceolate, inconspicuously spiculate, setae of segment V short, bristlelike; dorsals I arising behind middle of segment, 19μ (18-19) long, 39μ (37-42) apart; laterals I arising well anterior to dorsals I, 26μ (26-29), distance anterolaterad to respective dorsals nearly equal to that between dorsals; dorsals II subequal to laterals I in length, 80μ (78-83) apart; dorsals III like dorsals II, 36μ (36-42) apart; laterals III 21μ (21-24) long, about six areolar widths anterolaterad of respective dorsals; all setae of segment IV subequal in size, 14μ (14-15), dorsals 25μ (25-29) apart, laterals about the length of a seta anterolaterad; setae of segment V subequal in length, about five μ, distance between internal caudal and respective external caudal II 15μ (15-18); external caudal I distinctly closer to external caudal II than to internal caudal. *Venter.* First axillaries short, lanceolate, all remaining setae of posterior ventral plate nude and flagellate, variable in length; internal and external presternals subequal in length, externals distinctly mesad of internals and on transverse line with first axillaries; first axillaries about three times their own length mesad of anteromesal margin of coxal foramina III; second axillaries about 30μ long, internal poststernals about half as long, arising barely mesad of external presternals and well behind second axillaries; external poststernals about 40μ long, arising two areolar diameters posterior or posteromesad of sternocoxal condyles IV; apodemes III and IV fragmented.

Legs (all measurements in μ). *Length.* Leg I, 50 (47-51); leg II, 72 (72-74); leg III, 77 (75-80); leg IV, 110 (108-113). *Width.* Leg I, 13 (13-14); leg II, 17 (17-21); leg III, 14 (14-15); leg IV, 11 (11-14). *Segment lengths.* Tr I, 17 (14-17); tita I, 26 (26); tr II, 22 (22-24); ta II, 24 (24-25); ti III, 15 (14-16); ta III, 25 (24-25); cx IV, 33 (33-36); tr IV, 20 (18-22); fege IV, 11 (11-12); ta IV, 33 (33-34). *Setation.* Leg I: cx 1T, tr 3T + 1 specialized, fege 2T, tita 11T + 10S; leg II: cx IT, tr 3T, fege 2T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T (+ 1S?), ta 6T.

Tibiotarsus I with six rodlike and four short, stout solenidia, the most basal of the latter the smallest; trochanter I with one long seta which reaches basal third of tarsus; solenidia of tibiae II and III small, clavate, basal, that of tarsus II basal, short, subelliptical; tarsi II and III each with blunt, ventral, apical spur, each possessing two stout, spinose setae in addition; coxa IV distinctly arcuate;

sensory peg of tibia IV indistinct; tarsus IV with three greatly enlarged terminal setae, the apical about five times length of tarsus.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and three female paratypes (nos. 1 to 3) from Guatemala (taken in quarantine at Philadelphia, Pa., Feb. 3, 1936, A. B. Wells) from *Metamasius sp.* Philadelphia No. 29318, U. S. N. M. No. 36-2773.

TYPE REPOSITORIES. Holotype and two paratypes (nos. 2 and 3) in U. S. National Museum, Washington, D. C. One paratype (no. 1) in the Snow Entomological Museum, The University of Kansas, Lawrence, Kansas.

Microdispini, new tribe

This tribe includes five genera, four of which are new and described herein. Three (*Myrmecodispus, Glyphidomastax,* and *Perperipes*) have been found only in association with doryline ants.

DESCRIPTION OF NON-GRAVID FEMALE. *Gnathosoma.* Usually distinctly longer than wide or, if rarely wider than long, then palps free; palps normal or elongate and fitted for piercing.

Propodosoma. Dorsum. With one (usually) or two pairs of setae, if two pairs, then second pair visible only under high (1000X) magnification; peritremes widely separated, ovate, elongate-elliptical, or troughlike and cylindrical, never circular; three esophageal "finned" structures always present, the center one enlarged, the posterior reduced, never nearly equalling it and usually smaller than or as large as anterior. *Venter.* Anterior ventral plate always with four pairs of setae; external ventrals I not furcate.

Hysterosoma. Dorsum. First hysterosomal tergum often prolonged anteriorly to cover most or all of propodosoma, if so, then margins both free and radially striated or not; segment V with two (usually) or three pairs of setae; posterior portion of vaginal wall only rarely sclerotized, never enclosed in enlarged, elliptical to globose pumplike structure; posterior genital sclerite variable, only rarely (in some *Microdispus*) broadly triangular, flaplike. *Venter.* Apodemes V absent.

Legs. Legs I articulated obliquely to longitudinal axis of body, thinner and usually shorter than (rarely as long as) legs II; claw I often absent, if present, pedicellate; mediolateral "sclerotized plate" lacking on tibiotarsus I; trochanter I with three setae, seta *c* always setiform; trochanter IV usually shorter than, rarely as long as coxa IV.

Key to the Genera of the Tribe Microdispini (Females)

1(*a*). Leg IV without claws; tarsi II and III each with a pair of large, basal, subrectangulate setae; palps elongated and acuminate apically; associated with doryline ants 2

1(*b*). Leg IV with claws; tarsi II and III without setae modified as above; palps rarely elongated and acuminate apically; associated with doryline ants or not 3

2(*a*). Body elliptical in dorsoventral aspect; leg IV at least 20μ longer than leg III; posterior margin of first hysterosomal tergum with about 12 broad teeth . . . . *Glyphidomastax*, new genus, p. 184

2(*b*). Body circular to sublimuloid in dorsoventral aspect; leg IV not more than 15μ longer than leg III; posterior margin of first hysterosomal tergum lacking teeth . . . . *Perperipes*, new genus, p. 188

3(*a*). Gnathosoma distinctly wider than long; chelicerae enlarged and bladelike . . . . *Peponocara*, new genus, p. 179

3(*b*). Gnathosoma never distinctly wider than long; chelicerae usually indistinct, if distinct then not bladelike 4

4(*a*). Apodemes IV reaching the margins of coxal foramina III; opisthosomal sternum often with scalelike engravings; associated with doryline ants *Myrmecodispus*, new genus, p. 173

4(*b*). Apodemes IV never reaching more than, usually much less than four-fifths of distance to margins of coxal foramina III; opisthosomal sternum lacking engravings; associated with doryline ants or not *Microdispus*, p. 165

Microdispus Paoli

As conceived herein, this genus consists of at least eleven species placed in two subgenera, *Microdispus* and *Premicrodispus*. Although "typical" forms of these two groups differ markedly in their appearance, intergrades occur which are difficult to assign satisfactorily.

Largely because of the enlargement of the first hysterosomal tergum, *Microdispus* was originally placed in the family Scutacaridae by Paoli. In this paper, the genus is considered to be closely related to species of *Pseudopygmephorus* and therefore contains the least specialized forms of the tribe Microdispini.

Members of the genus differ from scutacarids and resemble most pyemotids in that the first hysterosomal segment does not project beyond the gnathosoma and lacks radial strengthening striations along its margins, because legs II and III are well separated, in that the posterior ventral plate is not well delimited laterally in front of coxae III, because the peritremes are usually dorsal and oval or cylindrical, in the length of the legs, the ventral position of coxal seta IV, the shape of the posterior genital sclerite, and in the location of the presternals, in that the posterior margin of the posterior ventral plate is often trilobate, by the setiform structure of seta *c*, the position of apodemes IV, and other characters. The genus presents an observable sequence of modifications of the posterior ventral plate accompanied by an interesting migration of setae. In most *Premicrodispus*, the first axillaries are situated nearly upon the coxal foramen. In *Microdispus*, these setae are progressively farther forward, and in some species may be the length of the coxa anterior to the latter. Apodemes IV, bearing the external presternals, undergo a similar but even more pronounced anterior migration and are often so close to apodemes III that the stem of the posterior median apodeme is very short or virtually absent.

Species are known from Europe, North and Central America, and Australia. Only the females are known.

DIAGNOSIS. Females of this genus are separable from those of *Pseudopygmephorus* by the characters of the tribe and from those of *Myrmecodispus* in lacking an engraved hysterosomal sternum and because apodemes IV do not reach coxal foramina III.

DESCRIPTION OF FEMALE. Small mites, length, 140 to 230μ; width, 50 to 130μ; distance between anterior sternocoxal condyles III, 40 to 75μ; hysterosoma elliptical to oval, its posterior margin broadly rounded or subtruncate; body weakly to moderately sclerotized, lacking integumental engravings, but most lateral portions of posterior ventral plate usually with 2 to 12 distinct pleats.

Gnathosoma. Well developed, slightly to distinctly longer than wide; palps with one or more apical teeth but not sharply acuminate; esophagus slender, appearing straight or variously spiralled or coiled.

Propodosoma. Dorsum. Inversely T-shaped or elongate and trapezoidal, slightly to well developed behind pseudostigmatal sockets; anterior portion of dorsum prolonged hoodlike over gnathosoma, foramen appearing ventral, only weakly sclerotized, not forming distinct collar; posterior margin to entire dorsum covered by first hysterosomal segment; one pair of propodosomal setae or (rarely), if two pairs, then second pair visible only under high (1000 ×) magnification; peritremes anterior, dorsal or dorsolateral, widely separated, diverging anteriorly, oval, elliptical, or elongate and troughlike, if the latter then terminating anteriorly in propodosomal "shoulders"; two or three subcontiguous esophageal "finned" structures present, the anterior present or not, if present, resembling a "bow-tie," the middle usually much the longest, rectangulate, the esophagus distinctly thickened within it, the third squarish, subglobose, or triangulate, often indistinct. *Venter.* Internal ventrals II arising anterior to external ventrals II, usually closer to them than to anterior median apodeme; external ventrals I not furcate; coxa I articulated at nearly a right angle to longitudinal axis of body or (usually) distinctly obliquely; apodemes II complete or incomplete medially, together V- or weakly W-shaped; secondary transverse suture present or absent; anterior median apodeme usually strong and complete, rarely incomplete or absent; posterior marginal apodemes well developed, complete; distinct band of conjunctival pleats absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. Four or five visible segments; first segment overlapping posterior quarter to entire propodosoma, but margins not projecting free, not radially striate; fifth segment well developed, completely covered by fourth in dorsal aspect or not, bearing (usually) two or three pairs of apicoventral setae; vulva apical or apicoventral, often indistinct; apical portion of vaginal wall not sclerotized, not enclosed by sclerotized elliptical to globose enlargement; posterior genital sclerite straplike to broadly triangular; anterior genital sclerite distinct, acuminate, variable in position. *Venter.* Posterior ventral plate entire, bearing five or six pairs of setae, its hind margin entire or tripartite, if tripartite then incisions extending anteriorly to posteromesal margins of coxal foramina IV; first axillaries arising nearly in line with or distinctly anterior to anterior margin of coxal foramina III; external presternals arising directly behind internal presternals or well laterad of them but always on apodemes IV; external poststernals present, not or only slightly posterior to line drawn between posterolateral margin of coxal foramina IV; internal poststernals present or (rarely) absent; apodemes III absent or present, if present straight, complete mesally; apodemes IV distinct only mesally, extending one-half to four-fifths of distance to coxal foramina III, directed towards anterior half of foraminal margin or (rarely) directed well anterior to foramina; posterior median apodeme distinct, extending posteriorly to vicinity of coxae IV; distinct band of opisthosomal conjunctival pleats absent; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV.

Legs. Leg I thinner than, shorter or as long as leg II; tibiotarsus I elongate, elliptical to cylindrical, as wide as or narrower than femurogenu I; pinnacula present or lacking, if present then terminal and bearing a pair of rodlike solenidia; mediolateral "sclerotized plate" of tibiotarsus I absent; claw I absent; tarsi II and III each with five or six tactile setae; solenidia of tibiae II and III (probably)[22] present; pretarsi short, one-quarter the length of the tarsi or less; claws II to III with or without basal dilations, distinctly larger than claws IV or not; length of pulvilli variable; coxa III triangular, subcordate or broadly crescent-shaped; coxa IV short-rectangulate to rectangulate, evenly dilate basally or with slight to pronounced basal bulblike dilation but lacking subbasal constriction; trochanter IV not longer, usually distinctly shorter than coxa IV; femurogenu IV with 1 seta; tarsus IV always distinctly longer than, often twice as long as tarsus III; ratio of femurogenu IV to tibiotarsus IV approximately 1:3.3 to 1:5.5.

Key to the Subgenera of *Microdispus* (Females)

1(*a*) With the following combination of characters: hind margin of posterior ventral plate entire; leg I distinctly shorter than leg II; apodemes IV meeting posterior median apodeme on or in front of line drawn between anterior sternocoxal condyles III........*Microdispus* s. str., p. 172

1(*b*). Hind margin of posterior ventral plate usually tripartite; leg I shorter than or as long as leg II; apodemes IV meeting posterior median apodeme on or posterior to line drawn between anterior sternocoxal condyles III........................*Premicrodispus,* new subgenus, p. 168

Premicrodispus, new subgenus

(Figs. 64-66)

Type, *Microdispus* (*Premicrodispus*) *chandleri,* new species.

Forms of this subgenus present an interesting morphological transition between certain forms of *Pseudopygmephorus* on the one hand and forms of *Microdispus s. str.* and *Myrmecodispus* on the other. Most *Premicrodispus* resemble most *Pseudopygmephorus* in general body shape, in the shape and location of apodemes IV, in the position of the presternals, in having a tripartite posterior ventral plate, in the shape and position of the pseudostigmata, in possessing an elongate gnathosoma and elongate legs I, in the shape of the propodosoma, and in other characters. They differ from *Pseudopygmephorus* in the tribal characters given above.

As presently conceived, the subgenus contains at least six species, four of which are previously undescribed. These fall into two distinct species groups. The first of these is most closely related to *Pseudopygmephorus* and includes four species, all found in decaying vegetation. Members of this group are widely distributed, one species (undescribed) known only from Australia, one from Europe and North America (*silvestris* Jacot, 1936), one reported only from

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[22] Not visible on some poorly mounted specimens of *Microdispus s. str.*

Europe (*angustus Krczal,* 1959) and one restricted to North America (*chandleri,* n. sp.). The second group, associated with insects, resembles certain species of *Myrmecodispus* in the shape of the hind margin of the anterior ventral plate, in the shape and size of claws II and III, and in having seta *l* of tibia IV enormously enlarged. Included in this group are two species, one phoretic upon the termite *Reticulitermes flavipes* in Indiana, the other from the doryline *Nomamyrmex hartigi* in Panamá. The discrepancy in hosts may be explained by the fact that the specimens of *N. hartigi* were raiding a termite colony when captured.

DIAGNOSIS. In addition to the key characters mentioned above, separable from most species of *Microdispus s. str.* as well as from *Myrmecodispus* by the shape of coxa IV, which is not or only barely bulbose and distinctly wider at base than at apex.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 140 to 210μ; width, 50 to 90μ; width between anterior sternocoxal condyles III, 40 to 75μ.

Propodosoma. Dorsum. Well developed behind pseudostigmatal sockets. *Venter.* Secondary transverse suture absent.

Hysterosoma. Dorsum. First segment overlapping only posterior third to quarter of propodosoma; posterior genital sclerite straplike or tonguelike, anterior genital sclerite well posterior to line drawn between posteromesal margins of coxal foramina IV. *Venter.* Hind margin of posterior ventral plate usually tripartite; first axillaries arising nearly in line with anteriormost margins of coxal foramina III; apodemes IV meeting posterior median apodeme on or behind line drawn between anteriormost margins of coxal foramina III.

Legs. Pinnacula of tibiotarsus I lacking; coxa III triangular to short-subcordate; coxa IV more or less evenly dilated toward the base, not or only barely bulbose basally; tarsus IV not usually twice as long as tarsus III, ratio of femurogenu IV to tarsus IV approximately 1:3.8 to 1:4.6.

Previously described forms thought to belong in *Premicrodispus:*

angustus (Krczal, 1959) (*Pygmephorus*)
silvestris (Jacot, 1936) (*Pygmephorus*)

HABITS. See above.

SPECIMENS EXAMINED. *P. silvestris* (Jacot) and four additional unidentified species from Kansas, Indiana, Panamá (C. Z.) and from Western Australia, from the following situations or hosts: *Eucalyptus* sp., punky stump, *Nomamyrmex hartigi* (Westwood) (Formicidae, Dorylinae), *Reticulitermes flavipes* (Kollar) (Isoptera).

Microdispus (*Premicrodispus*) *chandleri*,[23] new species

DIAGNOSIS. This species is most closely related to *silvestris*. It may be separated from that species, as well as from *angustus*, in that laterals III are spaced about two-thirds their own length from their respective dorsals, and by the three pairs of setae on segment V.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 156μ (148-162, $\bar{X} = 153.66$); Width[24] (79μ); width between anterior sternocoxal condyles III, 42μ (39-43, $\bar{X} = 41.60$); hysterosoma elliptical, weakly sclerotized, indistinctly punctate; posterior ventral plate laterad of legs with three to four longitudinal striae.

Gnathosoma. Rectangulate, length, 23μ (22-24, $\bar{X} = 22.66$); width, 12μ (12-13, $\bar{X} = 12.66$); internal dorsals submarginal, the externals small, marginal, usually not visible in dorsoventral aspect; solenidia I and II indistinct, probably absent; distance between first and second palpal setae about three μ; esophagus with series of two to four close spirals between buccal cavity and propodosomal "finned" structure.

Propodosoma. Dorsum. Thickly T-shaped; distance between internal pseudostigmatal sockets 25μ (22-25, $\bar{X} = 23.60$); single pair of pseudostigmatals appearing to arise on or near anteromesal margin of external pseudostigmatal sockets, these stout, as long as pseudostigmata, sparsely spiculate; peritremes elongate-elliptical, about two and one-half times longer than wide, anterior terminations lateral, not reaching anterior propodosomal margin. *Venter.* All ventral setae nude, flagellate, those of ventrites I subequal, about 12μ, externals II 17 to 20μ, internals II slightly shorter; apodemes II together U-shaped, complete; posterior marginal apodemes moderately arcuate.

Hysterosoma. Dorsum. Posterior margins of segments I to III emarginate, that of third much more broadly than others; all dorsal hysterosomal setae stout, sparsely spiculate; dorsals I arising about three-quarters of their own length posterior to laterals I, 14μ ($\bar{X} = 14.00$) long, 31μ (28-30, $\bar{X} = 29.80$) apart; laterals I 25μ (23-26, $\bar{X} = 23.83$) long; dorsals II subequal to dorsals I in size, 26μ (25-26, $\bar{X} = 25.50$) apart; dorsals III subequal to dorsals I and II in size, 18μ (15-18, $\bar{X} = 16.16$) long, 24μ (22-26, $\bar{X} = 24.00$) apart; laterals III 15μ (13-15, $\bar{X} = 13.83$) long, about two-thirds their own length

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[23] This species is named in honor of Dr. Leland Chandler, Department of Entomology, Purdue University, Lafayette, Indiana.

[24] This measurement not possible from holotype.

posterolaterad of dorsals III; setae of tergum IV in transverse row, dorsals IV 20μ long (19-21, $\bar{X} = 19.50$), only 9μ (8-9, $\bar{X} = 8.16$) apart, laterals IV 18μ (17-19, $\bar{X} = 17.80$) long, about twice as far from respective dorsals as dorsals from each other; setae of segment V equidistant from each other, the internal caudals and external caudals II subequal in size, approximately 17 to 19μ, external caudals I bristlelike, about seven to eight μ; vulva seemingly apicoventral, its posterior extremity marked by a crescentic line; posterior genital sclerite short and tablike. *Venter.* Posterior ventral plate with five pairs of setae (internal poststernals lacking), all nude, flagellate, about 13 to 19μ; external presternals only slightly laterad of external poststernals, in longitudinal line with internal presternals, about six to eight μ behind line drawn between posteromesal margins of coxal foramina IV; first axillaries immediately adjacent mesally to anterior sternocoxal condyles of coxae III.

Legs (all measurements in μ). *Length.* Leg I, 37 (37-39, $\bar{X} = 38.00$); leg II, 46 (41-47, $\bar{X} = 45.33$); leg III, 43 (37-43, $\bar{X} = 41.46$); leg IV, 62, (58-64, $\bar{X} = 61.80$). *Width.* Leg I, 8 (8-9, $\bar{X} = 8.16$); leg II, 11 (10-12, $\bar{X} = 11.66$); leg III, 9 (8-9, $\bar{X} = 8.66$); leg IV, 10 (9-11, $\bar{X} = 9.83$). *Segment lengths.* Tr I, 14 (14-15, $\bar{X} = 14.17$); tita I, 18 ($\bar{X} = 18.00$); tr II, 17 (14-17, $\bar{X} = 15.50$); ta II, 15 (15-17, $\bar{X} = 16.00$); ti III, 7 ($\bar{X} = 7.00$); ta III, 15 (13-15, $\bar{X} = 14.33$); cx IV, 20 (18-20, $\bar{X} = 19.33$); tr IV, 17 (15-17, $\bar{X} = 15.40$); fege IV, 6 (6-7, $\bar{X} = 6.50$); ta IV, 20 (20-22, $\bar{X} = 21.00$). *Setation.* Leg I: cx 0T, tr 3T, fege 4T, tita 10T + 9S; leg II: cx 1T, tr 3T, fege 2T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Tibiotarsus I with five rodlike and four, short, stout solenidia, the most anterior and lateral of the latter not reaching tip of segment; solenidia of tibiae subbasal; solenidium of tarsus II elongate, about eight μ; coxa III distinctly triangulate in ventral aspect; coxa IV quadrate, evenly and distinctly dilate toward the base; tarsus IV short, constricted abruptly three-fifths of distance to its apex; claws II to IV simple, subequal in size, pulvilli II to IV not longer than claws.

DISTRIBUTION. Known from Michigan, Indiana, and Georgia.

TYPE MATERIAL. Female holotype and five female paratypes from near Hovey Lake State Game Refuge, Posey County, Indiana, June 6, 1958, E. A. Cross, from rotten stump in wet woods (berlese sample). Purdue University No. PU580605-5.

TYPE REPOSITORIES. Holotype and one paratype (no. 3) in the U. S. National Museum. Two paratypes (nos. 1, 4) in the Snow Entomological Museum, The University of Kansas. One paratype (no. 2) in the Blatchley Collections, Purdue University, and one paratype (no. 5) in the Zoologisches Institut, Universität Erlangen, Erlangen, Germany.

Subgenus *Microdispus* Paoli s. str.

(Figs. 67-68)

Microdispus Paoli, 1911, Redia (Firenze), 7:267. Type, *Diversipes* (*Microdispus*) *obovatus* Paoli, 1911, by original designation.

Typical members of this group show several specializations also found in the family Scutacaridae, a fact which led Paoli to place *M. obovatus* in the genus *Diversipes*. These specializations include an anterior migration of the external presternals in addition to the characters mentioned in the following diagnosis. The author follows Krczal in the belief that the genus belongs in the Pyemotidae for reasons already given.

The subgenus includes at least five species from Europe, North America, and Australia.

Diagnosis. In addition to the key characters, the first hysterosomal tergum is usually elongated anteriorly to cover all or nearly all of the propodosoma, and tarsus IV is usually characteristically attenuate and always elongate (figs. 67-68).

DESCRIPTION OF NON-GRAVID FEMALE. Length, 130 to 230μ; width, 80 to 130μ; width between anterior sternocoxal condyles III, 45 to 65μ; hysterosoma usually oval, rarely elliptical.

Gnathosoma. Always distinctly longer than wide.

Propodosoma. Dorsum. Inversely T-shaped; one pair of propodosomal setae; peritremes elongate-troughlike, terminating anteriorly in propodosomal "shoulder." Apodemes II together, if complete, U-shaped.

Hysterosoma. Dorsum. First tergum usually elongated anteriorly to cover entire propodosoma; fifth segment always with two pairs of setae; posterior genital sclerite usually narrowly wedge-shaped, rarely broadly wedge-shaped or straplike. *Venter.* Posterior margin of posterior ventral plate entire, bearing six pairs of setae; first axillaries arising distinctly anterior to coxae III, usually by more than half the length of the foramen; internal poststernals present; apodemes IV joining posterior median apodeme on or (rarely) above line drawn between anterior sternocoxal condyles III.

Legs. Leg I distinctly shorter than leg II; tibiotarsus I elongate, cylindrical, slightly to distinctly narrower than femurogenu I; tarsi II and III with six tactiles; claws II and III with basal dilations, distinctly larger than claws IV; coxa IV broadly to narrowly rectangulate, barely to (usually) greatly dilated bulblike basally; trochanter IV distinctly shorter than coxa IV; tarsus IV elongate, usually characteristically evenly attenuate; ratio of femurogenu IV to tarsus IV approximately 1:3.3 to 1:5.5.

Species thought to belong to *Microdispus, s. str.:*

obovatus (Paoli, 1911) (*Diversipes,* Scutacaridae)
setosus (Evans, 1952) (*Diversipes*)

HABITS. Several species contain single, large eggs, suggesting that the size of the gravid female is similar to that of species of scutacarids and extreme physogastry is lacking. Habits are otherwise unknown.

SPECIMENS EXAMINED. Five species from the eastern part of the United States and from Australia (West Australia), from the following situations or hosts: leaf litter, pine litter, dead grass, molding hemlock and deciduous tree leaves, soil in peach orchard, punky stump in woods.

Myrmecodispus, new genus

(Figs. 69-71)

Type, *Myrmecodispus dorylinis,* new species.

This genus is erected to accommodate five undescribed species of microdispines, all of which are found in association with various Central American army ants. One species (no. 2) exhibits an interesting variability of gnathosomal dimensions, the gnathosomal length of some specimens being a fifth longer than that of others. Complete intergradation seemingly occurs between the two extremes.

Only the non-gravid females are known.

DIAGNOSIS. Females may be distinguished from those of the most closely related genus, *Microdispus,* by the following combination of characters: apodemes IV reaching the anteriormost margins of coxae III or nearly so; distinct subapical pinnacula present on tibiotarsus I. In addition, tarsus IV is very elongate, usually at least twice the length of tarsus III.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 140 to 235μ; width, 90 to 125μ; width between anterior sternocoxal condyles of coxae III, 58 to 95μ; hysterosoma elliptical to oval, its posterior margin broadly to rather sharply rounded; body moderately to distinctly sclerotized, opisthosomal venter usually with scalelike integumental engravings; most lateral portions of posterior ventral plate with 2 to 12 distinct pleats.

Gnathosoma. Longer than wide, often elongate and acuminate; palps with or without distinct apical teeth, sharply acuminate or not; chelicerae minute and indistinct to moderately distinct; esophagus plainly visible as a straight, simple tube.

Propodosoma. Dorsum. Quadrate-trapezoidal, not usually well developed behind pseudostigmatal sockets; anterior portion of dorsum prolonged hoodlike over gnathosoma, foramen appearing ventral, its lateral margins only weakly sclerotized, not forming distinct collar; posterior margin well covered by first hysterosomal segment; pseudostigmatal sockets arising from posterior third of dorsum; one pair of proposodosomal setae; peritremes widely separated, diverging anteriorly, ovate to ovate-elongate; two or three propodosomal "finned" structures present, the anterior resembling a "bow-tie," the middle always much the largest, rectangulate, the esophagus distinctly thickened within it, the third small, similar in size to the first. *Venter.* Ventrals I in nearly straight line across plate; internal ventrals II arising distinctly anterior to external ventrals II, distinctly closer to them than to anterior median apodeme; external ventrals I not forked; coxa I articulated distinctly obliquely to longitudinal axis of body; apodemes II weakly to moderately developed, often incomplete, if complete then together W-shaped or strongly arcuate; secondary transverse suture lacking; anterior median apodeme weakly to moderately developed, complete or incomplete; posterior marginal apodemes strongly arcuate or nearly forming a straight line, prominent to exceedingly well developed, often the most distinct apodemes upon the ventral surface; pleated conjunctival band absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment overlapping posterior one-quarter to posterior two-thirds of propodosoma; fifth segment always with two pairs apicoventral setae; vulva indistinct; apical portion of vaginal wall not sclerotized, not surrounded by apical, elliptical to globular pumplike enlargement; posterior genital sclerite straplike or tonguelike, anterior genital sclerite distinct, acuminate, well posterior to line drawn between posteromesal margins of coxae

IV or not. *Venter.* Hind margin of posterior ventral plate tripartite, incisions extending as far as foramen of coxa IV; posterior ventral plate with six pairs of setae; first axillary arising well anterior to coxa III; external presternal well posterior to internal but arising distinctly lateral to it, always on apodeme IV; external poststernal present, arising from posteromesal margin of coxal foramen or nearly so; apodemes III complete medially, weakly to moderately developed, always distinctly weaker than apodemes IV; apodemes IV well developed, complete medially and joining anterior margin to anterior one-fourth of coxal foramina III, usually joining posterior median apodeme at or above line drawn between anterior sternocoxal condyles; posterior median apodeme distinct, joining apodemes III anteriorly and extending posteriorly at least as far as line drawn between second axillaries; distinct band of opisthosomal conjunctival pleats absent; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV.

Legs. Leg I distinctly shorter and thinner than leg II; tibiotarsus I elliptoid, not wider than femurogenu I; one subapical pinnaculum present, bearing two or three rodlike sensory setae; mediolateral sclerotized plate lacking on tibiotarsus I; claw I absent to moderately developed, if present then always distinctly pedicellate and without thumb; tarsi II and III each with six tactile setae, solenidia of tibiae II and III present; pretarsi short, one-quarter length of tarsi or less; claws II and III stout and with distinct basal dilation, distinctly stouter than those of IV; pulvilli II to IV extending distinctly beyond claws; coxa III shortly subcordate to thickly crescent-shaped in ventral aspect; coxa IV short-rectangulate to rectangulate, not or barely bulbose basally; tarsus IV always very elongate and thin, nearly straight or tapering evenly, slightly less than to distinctly more than twice as long as tarsus III; ratio of femurogenu IV to tarsus IV, 1:4.3 to 1:9.0.

Habits. Little is known of the habits of these mites. To judge from the samples at hand, three species are apparently restricted in their host relationships to the single species *Nomamyrmex esenbecki.* The remaining two are found with more than one species of ant, *dorylinis* usually with *Eciton vagans* but rarely upon *E. hamatum*, and *Myrmecodispus species No. 1* from *E. vagans* and *E. dulcius.*

SPECIMENS EXAMINED. In addition to the type species as follows: *Species No. 1.* PANAMA (Canal Zone): Barro Colorado Island, 39 ♀ ♀ from *Eciton dulcius* Forel (Rettenmeyer Colony No. E-204); same, 1 ♀ from *E. vagans* (Olivier) (Colony No. E-154); same, 1 ♀ from *E. vagans* (Colony No. E-240); same, 4 ♀ ♀ from *E. vagans* (Colony No. E-180); same, 12 ♀ ♀ from *E. vagans* (Colony No. E-212). *Species No. 2.* PANAMA (Canal Zone): Barro Colorado Is., 20 ♀ ♀ from *Nomamyrmex esenbecki* (F. Smith) (Rettenmeyer Colony No. E-164). *Species No. 3.* PANAMA: Cerro Galera, 1 ♀ from *Nomamyrmex hartigi* (Westwood) (Rettenmeyer Colony No. D-118). *Species No. 4.* PANAMA (Canal Zone): Barro Colorado Is., 2 ♀ ♀ from *N. esenbecki* (Rettenmeyer Colony No. E-164).

Myrmecodispus dorylinis, new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 212μ (201-252, $\bar{X} = 215.10 \pm$ S. E. 2.43); width, 125μ (117-125, $\bar{X} = 120.33 \pm$ S. E. 0.70); distance between anterior sternocoxal condyles III, 90μ (80-90, $\bar{X} = 86.42 \pm$ S. E. 0.45); body ovate, moderately sclerotized, lacking integumental engravings.

Gnathosoma. Trapezoidal (appearing quadrate with palps extended); length, 30μ (24-30, $\bar{X} = 27.28 \pm$ S. E. 0.38); width, 24μ (22-24, $\bar{X} = 23.32 \pm$ S. E. 0.14); palps palmate, one dorsal tooth distinctly larger than rest; chelicerae of moderate size.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets, 52μ (47-55, $\bar{X} = 49.67 \pm$ S. E. 0.62); propodosomal seta about as long as pseudostigmatal pedicel. *Venter.* All setae moderate in size, nude, flagellate, 18 to 35μ long; internal ventral I only slightly larger than external ventral I, the former about 28μ long; internal ventral II less than width of one areolus of external ventral II anterior to external ventral II; apodemes II weak but complete, together W-shaped; posterior marginal apodemes heavy, straight, their most lateral corners bending dorsally, then anteriorly, to form large scapuloid plates.

Hysterosoma. Dorsum. First dorsal segment covering posterior one-third (posterior margin to posterior third) of propodosoma; setae of first segment in nearly transverse row, dorsals about a third longer than laterals and 77μ (69-77, $\bar{X} = 74.64 \pm$ S. E. 0.37) apart; dorsals II tiny, 9μ (8-12, $\bar{X} = 9.37 \pm$ S. E. 0.32) long, 67μ (58-68, $\bar{X} = 63.26 \pm$ S. E. 0.49) apart; dorsals III 57μ (51-58, $\bar{X} = 54.60$

± S. E. 0.37) apart, 69μ (59-75, $\bar{X} = 66.00$ ± S. E. 0.71) long; laterals III short, 18μ (13-19, $\bar{X} = 15.32$ ± S. E. 0.41) long, arising about half width of dorsal areolus laterad of dorsals; dorsals IV very elongate, 97μ (88-99, $\bar{X} = 93.72$ ± S. E. 0.71) long, 32μ (28-32, $\bar{X} = 30.63$ ± S. E. 0.18) apart; laterals IV subequal in size to laterals III but laterad of dorsals IV by the width of the dorsal areolus or more; internal caudals about 18μ, external caudals II about half the size of the internals and placed about length of dorsals II laterad of latter. *Venter.* All setae of posterior ventral plate flagellate, 14 to 29μ long, first and second axillaries and external poststernals subequal in size, distinctly larger than other three pairs; apodemes III moderately developed, complete medially and extending laterally beyond anteriormost margin of coxae foramina III, there recurving slightly; apodemes IV stout, becoming more so at sides, extending laterally to meet coxal foramina III along anterior margins, meeting posterior median apodeme behind line drawn between anterior margins of coxal foramina; external presternals arising distinctly laterad of internal presternals and larger than them; internal poststernals spaced subequally between second axillaries; external poststernals extending less than half way to posteriormost margin of opisthosoma; opisthosomal venter without scalelike engravings, its posterior margin entire.

Legs (all measurements in μ). *Length.* Leg I, 44 (39-44, $\bar{X} = 42.24$ ± S. E. 0.28); leg II, 66 (59-66, $\bar{X} = 62.24$ ± S. E. 0.30); leg III, 74 (68-74, $\bar{X} = 71.27$ ± S. E. 0.44); leg IV, 123 (117-124, $\bar{X} = 121.24$ ± S. E. 0.38). *Width.* Leg I, 14 (10-15, $\bar{X} = 13.68$ ± S. E. 0.24); leg II, 23 (19-24, $\bar{X} = 22.16$ ± S. E. 0.23); leg III, 20 (19-22, $\bar{X} = 20.24$ ± S. E. 0.18); leg IV, 19 (14-20, $\bar{X} = 17.92$ ± S. E. 0.32). *Segment lengths.* Tr I, 13 (13-14, $\bar{X} = 13.48$ ± S. E. 0.10); tita I, 22 (20-22, $\bar{X} = 21.04$ ± S. E. 0.14); ta II, 19 (15-19, $\bar{X} = 18.24$ ± S. E. 0.23); ti III, 14 (13-14, $\bar{X} = 13.28$ ± S. E. 0.09); ta III, 21 (17-21, $\bar{X} = 18.88$ ± S. E. 0.19); cx IV, 36 (35-37, $\bar{X} = 36.16$ ± S. E. 0.16); tr IV, 24 (22-24, $\bar{X} = 22.64$ ± S. E. 0.15); fege IV, 10 (9-10, $\bar{X} = 9.64$ ± S. E. 0.14); ta IV, 48 (47-50, $\bar{X} = 47.68$ ± S. E. 0.18). *Setation.* Leg I: cx 1T, tr 3T, fege 4T, tita 11S + 10T; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Legs II and III stout, barely tapering from trochanter to tibia; tarsi II and III short and constricted abruptly; tibiotarsus I elliptoid-tapering, with moderately sized claw borne upon distinct pedicel; pinnaculum short and broad, bearing two setae; dorsolateral margin of tibiotarsus I with three prominent bullet-shaped solenidia subequal in size and distance from one another, another solenidium present distally and basally to these; solenidium of tarsus II short and broadly clavate; coxa IV not basally bulbose; solenidium of tibia IV broader than that of III; tarsus IV moderately elongate, ratio of length of femurogenu IV to tarsus IV about 1:4.9.

VARIATION. Only a comparatively slight amount of variation was noted in this species, perhaps because many of the specimens examined were from the same ant colony. Asymmetrical variation between members of the same pair of caudal setae was found and, in such cases, the average length of the two setae was given as the length. This average is usually surprisingly similar to the individual measurements made from more "normal" specimens. It is thought that much of the variation in the width of the legs was due to the amount of pressure upon them and it was definitely noticed that the thinnest legs were associated with the highest mounts. Although only a few specimens of the former were available, there were no noticable differences between specimens found upon the two hosts *E. burchelli* and *E. vagans.*

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and five female paratypes (nos. 5, 6, 7, 9, and 10) from Barro Colorado Island, Canal Zone, Panamá, August 7, 1956, M. E. and C. W. Rettenmeyer, from *Eciton vagans* (Olivier). Ten female paratypes (nos. 1, 2, 3, 4, 11, 12, 13, 14, 20, 24) as preceding but collected July 9, 1956. Three female paratypes (nos. 15, 16, 17) as above but collected May 31, 1956. Three female paratypes (nos. 8, 18, 19) as above but collected April 30, 1956. Three female paratypes (nos. 21, 22, 23) as above but collected August 17, 1956, from *Eciton burchelli* (Westwood).

TYPE REPOSITORIES. Holotoype and eight paratypes (nos. 1, 2, 5, 6, 20, 21, 22, 23) in the Snow Entomological Museum, The University of Kansas, five paratypes (nos. 3, 7, 16, 18, 19) in the U. S. National Museum, Washington, D. C., two paratypes (nos. 9 and 15) in the Zoologisches Institut, Universität Erlangen, Erlangen, Germany, two paratypes (nos. 4 and 8) in the British Museum (Natural History), two paratypes (nos. 10 and 11) in the Chicago Natural History Museum, two paratypes (nos. 12 and 13) in the

American Museum of Natural History, New York City, and two paratypes (nos. 14 and 17) in the private collection of Carl W. Rettenmeyer, Kansas State University.

MATERIAL EXAMINED. Other than the type series, as follows: PANAMA (C. Z.): Barro Colorado Is., 163 ♀ ♀ from *Eciton vagans* as follows: Rettenmeyer Colony no. E-180, 11 ♀ ♀; no. E-219, 4 ♀ ♀; no. E-154, 32 ♀ ♀; no. E-212, 49 ♀ ♀; no. E-240, 67 ♀ ♀. Same, from *E. burchelli*, Colony no. E-253, 8 ♀ ♀.

Peponocara, new genus

(Figs. 78-80)

Type, *Peponocara cathistes*, new species.

This genus is erected to include a single new species of relatively unspecialized microdispine mite taken from a polyphagine roach, upon which it is probably parasitic. Superficially resembling a long-legged form near *Premicrodispus*, the species differs greatly from all other microdispines in the structure and shape of the gnathosoma. Gravid and non-gravid females are similar in appearance since, in the manner of *Microdispus*, the female seemingly matures only one egg at a time.

DIAGNOSIS. Females are distinguishable from those of all other microdispine pyemotids by the shape and structure of the spherical, flattened gnathosoma. This structure has expanded anteriorly and laterally, with a consequent diminution and ventral displacement of the mouthparts. The chelicerae are large and distinctly bladelike, often extruded. Males and immatures are unknown.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 175 to 250μ; width, 110 to 150μ (these variations due in part to enlargement of hysterosoma in gravid females); width between anterior sternocoxal condyles of coxae III, 70 to 75μ; hysterosoma ovate, its posterior margin well rounded; posterior margin of first hysterosomal segment lacking broad teeth; body moderately sclerotized; posterior portions of dorsal segments and of posterior ventral plate and often of opisthosomal venter with irregular, impressed lines, these usually increasingly distinct posteriorly; striae present on most lateral portions of posterior ventral plate but often difficult to see; punctae usually indistinct.

Gnathosoma. Well developed, free, greatly expanded laterally and slightly expanded anteriorly to displace and enclose mouthparts ventrally; palps distinct but greatly reduced, their apices with at least one broad tooth; chelicerae enlarged, the stylets distinctly bladelike, often extruded, the guttate cheliceral bases prominent dorsally within the gnathosoma, separated by a heavily sclerotized septum that is bifurcate and recurved posteriorly; ventral esophageal-pharyngeal pump absent but posterior portion of bucca enlarged pumplike; esophagus plainly visible as moderately thick, straight tube possessing Z-like dorsal bend at posterior portion of gnathosoma or anterior part of propodosoma.

Propodosoma. Dorsum. Outline trapezoidal, about half as long as wide; lateral margins of gnathosomal foramen weakly developed, not forming a distinct collar; posterior margin well defined by apodeme, barely covered by first hysterosomal segment; one pair propodosomal setae arising directly in front of pseudostigmata; peritremes in anterior third, large, guttate and diverging about 150 degrees, opening near dorsolateral angles; three subcontiguous esophageal "finned" structures present, the anteriormost resembling a "bow-tie," the middle much the largest, rectangulate, the esophagus distinctly thickened within it, the posteriormost tiny, undulate. *Venter.* Ventral setae I nearly in transverse line; internal ventrals II well anterior to external ventrals II and much closer to them than to anterior median apodeme; external sternals I not forked; coxa I arising from ventral plate distinctly obliquely to longitudinal axis of body; apodemes II well developed and complete; secondary transverse suture lacking; anterior median apodeme intermittent behind apodemes II; posterior portion of anterior ventral plate not elongate, distance between apodemes I and II subequal to that between apodemes II and posterior marginal apodeme; posterior marginal apodemes straight, well developed, increasingly so laterally; pleated conjunctival band between propodosoma and hysterosoma absent.

Hysterosoma. Dorsum. Anterior margin of first segment barely covering posterior margin of propodosoma; fifth segment well developed but usually completely enclosed by fourth in dorsal aspect, bearing two pairs ventral setae; apical portion of vaginal wall not sclerotized, not surrounded by apical, sclerotized, elliptical to globose pumplike enlargement; vulva apical, moderately distinct; posterior vaginal sclerite distinct, irregularly spherical; posterior ventral plate with six pairs setae, its posterior margin entire; first axillaries about one-third length of coxa III anterior to coxae III; external presternals nearly directly behind internals, arising from apodemes IV; external poststernals present, arising barely mesad of and posterior to posteromesal margins of coxal foramina IV; apodemes III indistinctly present, oblique, complete medially; apodemes IV moderately developed, complete medially but short, reaching less than half the distance to the foramina of coxae III, directed toward anterior sternocoxal condyles, meeting posterior median apodeme on level with line drawn between anteriormost foraminal margins; posterior median apodeme short, often faint, arising anteriorly at Y-shaped juncture with apodemes III, terminating posteriorly near line drawn between second axillaries; posterior ventral plate laterad of legs with series of six to ten nearly parallel striations, these often indistinct depending upon mount; band of opisthosomal conjunctival pleats lacking; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV; opisthosomal venter lacking scalelike engravings except occasional irregular lines near hind margin.

Legs. Moderately elongate to (leg IV) elongate, slender; leg I much longer than gnathosoma but distinctly shorter and thinner than leg II; tibiotarsus I elongate-elliptical, not wider than femurogenu I, lacking distinct pinnacula and mediolateral sclerotized area; claw I absent; tarsi II and III each with six normal tactiles; pretarsi short, a quarter the length of the tarsi or less, dilated toward the apex; claws II and III stout but short, without inner basal dilation; claws IV present but reduced, less than half size of preceding two pairs; pulvilli extending distinctly beyond claws; coxa III elongate, subcordate in ventral aspect; coxa IV rectangulate, slightly constricted at basal third; trochanter IV only slightly shorter than coxa IV; femurogenu IV elongate, about twice as long as wide, bearing one seta; tarsus IV thin and elongate, ratio of femurogenu IV to tarsus IV about 1:3.5.

HABITS. Little is known of the habits of the single extant species. All specimens seen by the author were part of a single series taken from the polyphagine roach *Arenivaga apacha* (Saussure). The host roach belongs to a small, rather unique group of deserticolous species known in the United States only from the arid southwest. Because of the enlarged and bladelike chelicerae and because the gnathosoma has been torn from many of the specimens seen by the author, it is inferred that the species is a parasite which attaches rather firmly to the host. This belief is further strengthened in that many of the females are gravid.

In gravid females, extreme physogastry does not occur and the various segments remain telescoped within one another although an increase in hysterosomal size is obvious. All those examined possessed only a single, very large egg, this oval, 125 to 143μ long, 98 to 115μ wide. The extrusion of this egg through the apical vulva is seemingly impossible, and oviposition must occur either through some secondary opening or through hysterosomal breakdown. The author believes the former to be the case, positions and aspect of the vaginal sclerotizations and of the tissues between them being quite similar to those of *Perperipes* except for the muscular common oviduct, which was not observed in *Peponocara.* The distance between anterior and posterior vaginal sclerotizations is about 80 to 90μ in length, large enough to permit passage of the egg.

Males and immatures are unknown.

Peponocara cathistes, new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 178μ (178-241); width, 117μ (117-140); distance between anterior sternocoxal condyles III, 74μ (69-75).

Gnathosoma. Length, 24μ (23-25); width, 39μ (35-39); dorsal setae arising well laterad and in anterior fifth, usually appearing marginal; posteriors well posterolaterad of anteriors.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets, 46μ (41-47); propodosomal seta long, 45 to 50μ, nude. *Venter.* Setae rather stout, length about 17 to 40μ, setiform or flagellate, nude; ventrals I of similar shape and size, arising nearly in a straight line; internal ventrals II much smaller than external ventrals and arising distinctly mesad of them; a straight line drawn between externals I and II well laterad of internal ventrals II; apodemes II broadly and flatly U-shaped.

Hysterosoma. Dorsum. All dorsal setae nude, elongate-flagellate; setae of first segment in straight line; dorsals I distinctly farther from each other than from respective laterals, and longer than them, length, 61μ (53-63); dorsals II slightly shorter than dorsals I and arising only 20μ (19-23) apart; dorsals III 42μ (41-45) apart, —[25] (39-50) long, laterals III much shorter, —[25] (17-24), arising well laterad of and equally posterior to dorsals; all setae of segment IV subequal in size, about 25 to 30μ, laterals slightly anterior to dorsals and much farther from them than dorsals from each other;

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[25] This measurement not obtainable from holotype.

setae of segment V apicoventral, internal caudals 15μ (14-18) long, as far from each other as from external caudals II, latter 21μ (18-23) long; external caudals I 8μ (8-12), distinctly closer to internal caudals than to external caudals II. *Venter.* All setae of posterior ventral plate nude, lanceolate-flagellate, about 17μ (internal presternals) to about 41μ (external poststernals) long; first axillaries well mesad of anterior sternocoxal condyles of coxae III; second axillaries arising between mid point and posterior third of coxal foramina III; external presternals twice as wide and about one and one-half times as long as internal presternals; internal poststernals arising slightly anterior to line drawn between posterior sternocoxal condyles IV; external poststernals reaching slightly more than half way to posteriormost margin of opisthosoma; posterior margin of opisthosomal venter irregularly sinuate, especially mesally.

Legs (all measurements in μ). *Length.* Leg I, 41 (36-41); leg II, —[26] (55-58); leg III, 64 (58-66); leg IV, 108 (108-112). *Width.* Leg I, 7 (7-8); leg II, 12 (9-12); leg III, 7 (7-9); leg IV, 7 (7-8). *Segment lengths.* Tr I, 14 (14-15); tita I, 20 (19-20); ta II —[26], (20-23); ti III, 11 (11-12); ta III, 23 (20-23); cx IV, 26 (25-26); tr IV, 22 (19-23); fege IV, 13 (12-13); ta IV, 41 (40-41). *Setation.* Leg I: cx 1T, tr 3T, fege 4T, tita 11T + 9S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T. Tibiotarsus I with four lateral clavate or bullet-shaped solenidia of which the most basal is distinctly the longest, remaining five sensory setae rodlike; solenidia of tibiae II and III arising from near middle of segment; solenidium of tarsus II large, reaching areolus of tactile seta above it; coxa IV slightly constricted at basal third, enlarged dorsally distad of constriction, much wider than other segments of leg; external setae of trochanter and tibia IV distinctly longer than other setae of leg, that of trochanter reaching to tip of tarsus.

VARIATION. No unusual degree of variation was observed in the small series examined.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and four female paratypes (two gravid) from Presidio, Presidio Co., Texas, September 5, 1949, J. H. Russell, from the blattid *Arenivaga apacha* (Saussure), U. S. N. M. Lot no. 49-19208.

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[26] This measurement not possible on holotype specimen.

TYPE REPOSITORIES. Holotype and three paratypes (nos. 1, 3, 4) in the U. S. National Museum, Washington, D. C. Remaining paratype in the Snow Entomological Museum, The University of Kansas.

SPECIMENS EXAMINED. Same data as type series, 5 females.

HABITS. See generic description.

Glyphidomastax, new genus

(Figs. 72-74)

Type, *Glyphidomastax rettenmeyeri*, new species.

This genus is erected to accommodate a single, rare, previously undescribed species found phoretic upon the two species of North American army ants *Neivamyrmex opacithorax* (Emery) and *N. nigrescens* (Cresson). Because of its heavy sclerotization, the shape of tarsus IV, and the character and size of the first hysterosomal tergum, the species superficially appears to belong to the family Scutacaridae. There seems little doubt, however, that it is most closely related to species of *Myrmecodispus*, also associated with doryline ants. It is, however, much more specialized than members of that genus, particularly as regards the gnathosoma, the shape of the body, and modifications of the tarsi and tarsal setae.

The mite is immediately separable from any scutacarid species in that seta *c* of trochanter I is setiform, by the shape of the propodosoma, in possessing only one pair of propodosomal setae, in that external caudals I are vestigial, because of the shape of apodemes IV and of the anterior ventral plate, in that the posterior genital sclerite is not broadly wedge-shaped, in the shape of the gnathosoma and palps, in that the posterior ventral plate is not defined laterally in front of coxae III, and other characters.

Only the non-gravid female is known.

DIAGNOSIS. Females are distinguished from those of all other genera except *Perperipes* in possessing a pair of enormous, rectangulate setae basally on tarsi II and III, by the shape of the gnathosoma, which is long and acuminate, and more especially by the shape of the palps, which are elongate and sharp, as if fitted for piercing. The body is elliptical and heavily sclerotized, unlike that of *Perperipes*.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 290 to 315μ; width, 160 to 185μ; width between anterior sternocoxal condyles III, 100 to 108μ; hysterosoma elliptical, posterior margin evenly rounded; posterior margin of first hysterosomal segment with comb of about

12 broad, short teeth; body well sclerotized, without "pebblings" or scalelike engravings but finely and evenly punctate; most lateral portions of posterior ventral plate without pleats but finely striate.

Gnathosoma. Well developed, acuminate, much longer than wide; palps unique, elongate, comprising about two-thirds length of gnathosoma, each terminating in two elongate bladelike teeth; chelicerae indistinct, perhaps degenerate; ventral esophageal-pharyngeal pump absent; bucca well defined; esophagus plainly visible as a simple, thick, straight tube, not spiralled or coiled within a membranous pouch.

Propodosoma. Dorsum. Anterior portion rounded, sides diverging posteriorly, posterior portion of plate indistinct; anterior portion prolonged hoodlike over gnathosoma, circumgnathosomal foramen ventral, its lateral margins only weakly sclerotized, not forming distinct collar; first hysterosomal segment covering entire dorsum; one pair of propodosomal setae; peritremes large, in anterior half, widely separated, elongate-oval, opening laterally; three subcontiguous esophageal "finned" structures present, the middle one greatly enlarged, its fins uneven and crooked, the anterior and posterior ones reduced. *Venter.* Ventrals I not in a straight transverse line; internal ventrals II arising well anterior to external ventrals and much closer to them than to anterior median apodeme; external ventrals I not forked; coxa I articulated to anterior ventral plate at angle oblique to longitudinal axis of body; apodemes II weakly to moderately developed, each present laterally and medially but absent between; secondary transverse suture lacking; anterior median apodeme moderately developed, broken two or three times posterior to junction of apodemes II; posterior marginal apodemes greatly enlarged, ten times width of anterior median apodeme, together forming an arc; pleated conjunctival band absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment semicircular and expanded anteriorly, completely covering propodosoma, margins projecting free and with radial striae, covering base of gnathosoma and basal two or three segments of legs I and II; fifth segment bearing three pairs of ventral setae, the middle pair degenerate; vulva apicoventral, indistinct; apical portion of vagina not surrounded by sclerotized, pumplike enlargement; posterior genital sclerite well internal, irregularly shaped; anterior genital sclerite acuminate, its anterior margin on line drawn between posteromesal margins of coxae IV.

Venter. Posterior ventral plate bearing six pairs of setae, greatly elongated anteriorly; hind margin of posterior ventral plate entire; external presternals well posterior to and slightly mesad of internal presternals, arising slightly in front of apodemes IV; external poststernals present; apodemes III absent or weak and hidden beneath greatly enlarged posterior marginal apodemes of anterior ventral plate; apodemes IV greatly enlarged, straight and perpendicular to longitudinal axis of body, complete medially and joining coxal foramina III at their anteriormost margins; posterior median apodeme arising between internal presternals and terminating posteriorly in region of internal poststernals; posterior ventral plate laterad of legs with numerous striae, apical striations less pronounced than basal; distinct band of opisthosomal conjunctival pleats absent; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV; opisthosomal venter lacking scalelike integumental engravings.

Legs. All legs comparatively short and stout, leg I extremely short, approximately the length of gnathosoma, distinctly narrower than leg II; tibiotarsus I subtriangulate, not wider than femurogenu I; distinct pinnacula and mediolateral sclerotized plate lacking on tibiotarsus I; claw I absent; tarsi II and III each with three normal tactiles and two enormous tactiles, the latter heavily sclerotized, rectangulate, bearing apical prickle; solenidia of tibiae II and III present; pretarsi short, one-quarter length of tarsi or less; claws II and III stout, with distinct basal dilations, claws IV lacking; pulvilli II and III extending distinctly beyond claws; coxa III subcordate in ventral aspect; coxa IV subrectangulate, slightly narrowed basally; trochanter IV less than half as long as coxa IV; femurogenu IV bandlike, bearing one seta; tarsus IV elongate and thin, evenly attenuate or nearly so, much less than twice as long as tarsus III; ratio of femurogenu IV to tarsus IV, 1:10.0.

Glyphidomastax rettenmeyeri, new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 296µ (315); width, 159µ (186); distance between anterior sternocoxal condyles III, 101µ (111).

Gnathosoma. Length, 50µ (51); width, 19µ (20); distance between palpal setae, 11µ (12); posterior dorsal setae well behind and laterad of anterior dorsals (or appearing directly behind).

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets, 48μ (52); propodosomal seta short and nude, 9μ (8), situated on prominence about its own length anterior to pseudostigmatal organ; apodeme delimiting posterior margin of plate lacking. *Venter.* Setae moderate to stout in size, length, 28 to 55μ, flagellate, nude to sparsely plumose; internals I about 55μ, half again as large as externals I; internals and externals II subequal in size, about 43μ, both pairs approximate to coxal foramen II, internals nearly as far from externals II as from externals I; anterior ventral plate elongated behind apodemes II, distance between apodemes I and II much less than that between apodemes II and posterior marginal apodemes.

Hysterosoma. Dorsum. Setae of first segment slender, flagellate, dorsals weakly plumose, slightly shorter than and posterior to nude laterals; setae of segments II to V stout and weakly plumose; dorsals II 88μ (85) apart, 55μ (63) long, located above centers of coxae III; dorsals III 70μ (76) apart, 74μ (78) long, laterals III well anterior and lateral of dorsals, nearly marginal, 66μ (66) in length; setae of segment IV spaced subequally, dorsals 68μ (72) long, laterals longer, 88μ (96); setae of segment V distinctly ventral, internal caudals 52μ (52), external caudals I rudimentary, their areoli contiguous with those of internals; external caudals II about two areolar widths laterad of internal caudals, 33μ (31) in length. *Venter.* All setae of posterior ventral plate nude, flagellate, 22 to 50μ; first axillaries anterior to coxal foramina III by about length of coxa III; apodemes IV forming a straight line; second axillaries arising from posterior third of margin of coxal foramina III; external presternals about two-thirds length of internal presternals; internal poststernals close together, straddling posterior median apodeme, arising anterior to second axillaries; external poststernals extending less than half way to posteriormost margin of opisthosoma; opisthosomal venter without scalelike engravings, its posterior margin entire.

Legs (all measurements in μ). *Length.* Leg I, 48 (48); leg II, 86 (90); leg III, 88 (90); leg IV, 120 (123). *Width.* Leg I, 19 (20); leg II, 30 (30); leg III, 22 (24); leg IV, 21 (22). *Segment lengths.* Tr I, 17 (15); tita I, 25 (24); ta II, 39 (37); tr IV, 20 (19); fege IV, 4 (5); ta IV, 55 (55). *Setation.* Leg I: cx 1T, tr 3T, fege 4T, tita 11T + 9S; leg II: cx 1T, tr 3T, ti 4T + 1S, ta 5T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 5T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Tarsi II and III conical and elongate; all but one sensory seta of tibiotarsus I setiform or rodlike, the exception lateral, clavate; solenidium of tarsus II large and bullet-shaped, bearing apical prickle; the two setae of trochanter IV and two of tibia IV subequal in width, greatly enlarged, wider than any other setae of leg.

HABITS. Nothing is known of the habits of this species.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and one female paratype from The University of Kansas Natural History Reservation, Lawrence, Kansas, April 10, 1957, C. W. Rettenmeyer, from body of *Neivamyrmex opacithorax* (Emery).

TYPE REPOSITORIES. Holotype and single paratype in Snow Entomological Museum, The University of Kansas.

OTHER SPECIMENS EXAMINED. KANSAS: Lawrence, 1 ♀ from *Neivamyrmex nigrescens* (Cresson).

Perperipes, new genus

(Figs. 8-9, 75-77)

Type, *Perperipes ornithocephala*, new species.

This myrmecophilous genus is erected to accommodate three closely related forms apparently restricted to Central American doryline ants. The three forms concerned are separable only in relatively minor size and setal differences.

Upon superficial examination, they resemble scutacarid mites quite closely and are the members of the family Pyemotidate most likely to be misplaced into that family. In reality, *Perperipes* is most closely related to the microdispine genus *Glyphidomastax*, resembling that genus in the shape and placement of the peritremes, in the structure of the esophagus, in the conformation of the palpi and reduction of the chelicerae, in the structure of the esophageal "finned" structure, in the modified basal setae of tarsi II and III, and in the enlargement of the first hysterosomal segment. It differs from *Glyphidomastax* in body shape and in numerous other structural modifications. The genus is typically microdispine in possessing but one pair of dorsal propodosomal setae and two pairs of setae on segment V, in that the gnathosoma is elongate and because seta *c* of trochanter I is unmodified. It resembles members of the family Scutacaridae in body shape, in having an enlarged first hysterosomal segment which completely covers the propodosoma and which projects slightly over the base of the gnathosoma and the basal segments of legs I and II, and whose margins are free anteriorly and laterally, as well as in the modification of legs IV. The genus differs from all or most scutacarids in that seta *c* of trochanter I is unmodified, in that the seta of coxa IV is basal rather than lateral, because the posterior genital sclerite is not definitely triangular in outline, in the shape and location of the stigmata, because the external presternals arise from apodemes IV, in that the propodosomal dorsum bears only one pair of setae, because segment V has only two pairs of setae, because pretarsus IV is not elongate, in lacking pinnacula on tibiotarsus I, in the shape of the propodosoma, and because females become enormously physogastric when gravid.

Both gravid and non-gravid females are known.

DIAGNOSIS. Non-gravid females separable from those of all other pyemotid genera because the body is circular or sublimuloid in dorsoventral aspect. Further separable from all genera except *Glyphidomastax* in that tarsi II and III each possess a pair of greatly enlarged, subrectangulate basal setae and because the gnathosoma is greatly elongated, the palps fitted for piercing. Gravid females differ from those of other known genera in that the physogastric hysterosoma becomes elongate-cylindrical, possessing pseudosegments (see p. 61).

DESCRIPTION OF NON-GRAVID FEMALE. Length, 200 to 250μ; width, 200 to 215μ; width between anterior sternocoxal condyles of coxae III, 90 to 100μ; hysterosoma broadly ovate, mites nearly circular or circular-limuloid as seen in dorsoventral aspect; posterior margin of first hysterosomal segment lacking broad teeth; body well sclerotized, without scalelike or "pebbled" integumental markings, not striate on most lateral portions of posterior ventral plate but heavily and finely punctate.

Gnathosoma. Greatly elongate and much longer than wide, resembling skull of bird; palps distinct, greatly elongate, comprising about three-fourths length of gnathosoma, bladelike, simple, lacking distinct apical teeth; cheliceral bases distinct, converging apically, but blades degenerate and not fitted for piercing; bucca well defined; esophagus plainly visible as simple, thick, straight tube, not spiralled or coiled within a membranous pouch.

Propodosoma. Dorsum. Outline indistinct and variable depending upon mount but much broader than long, anterior margin more or less evenly rounded, prolonged hoodlike over gnathosoma, foramen ventral but only weakly sclerotized, not forming distinct collar; posterior margin indistinct; entire dorsum covered by first hysterosomal tergum; one pair of proposodsomal setae arising laterad of pseudostigmata; peritremes in anterior third, large, ovoid, widely separated, opening near anterodorsal angles of propodosoma, often appearing to open in propodosomal "shoulders," depending upon mount; esophageal "finned" structures characteristic, the middle one much the largest, its "fins" uneven and crooked, the anterior one "bow-tie" shaped, distinctly longer than the posterior one. *Venter.* Ventrals I not nearly in a transverse line; internal ventrals II well anterior to external ventrals II and much closer to them than to anterior median apodeme, both pairs approximate to coxal foramina II; secondary transverse suture lacking; anterior median apodeme moderately developed, complete; posterior portion of anterior ventral plate not elongate, distance between apodemes I and II only slightly less than that between apodemes II and posterior marginal apodemes; posterior marginal apodemes well developed, increasingly so laterally, mesal portions about same thickness as posterior median apodeme; pleated conjunctival band between propodosoma and hysterosoma indistinctly present dorsally.

Hysterosoma. Dorsum. First segment semicircular, expanded laterally and anteriorly, completely covering propodosomal dorsum and projecting slightly beyond, its free periphery with narrow band of indistinct radial striae; fifth segment bearing two pairs of ventral setae; vulva apicoventral, usually distinct; apical portion of vagina well sclerotized but not surrounded by apical, sclerotized, elliptical to globose pumplike enlargement; posterior genital sclerite well internal, small, irregular or crescent-shaped; two anterior genital sclerites present, the anteriormost broadly omega-shaped, the other irregular. *Venter.* Posterior ventral plate not elongated anteriorly, bearing six pairs of setae, its hind margin entire; external presternals well posterior to and slightly mesad of internal presternals, arising from apodemes IV; external poststernals present, arising adjacent to posterior sclerotization of coxal foramina IV; apodemes III only weakly present; apodemes IV well developed, complete, arcuate, joining coxae III near anterior sternocoxal condyles, meeting posterior median apodeme on level with line drawn between centers of coxal foramina III; posterior median apodeme arising anteriorly between internal presternals, often falsely appearing to be a posterior prolongation of anterior median apodeme; posterior ventral plate laterad of legs without distinct striae or integumental pleats, but thick band of lateral conjunctival pleats present, sometimes indistinct; thick bands of opisthosomal conjunctival pleats also present ventrally beneath opisthosomal venter and dorsally between segments III and IV and between IV and V; opisthosoma as long as or slightly shorter than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV; opisthosomal venter lacking scalelike integumental engravings.

Legs. Short and stout, leg IV reduced; leg I distinctly shorter than gnathosoma, thinner than leg II; tibiotarsus I subquadrate, not wider than femurogenu I, lacking distinct pinnacula and mediolateral sclerotized area; claw I medium-sized, borne on thick pedicel, pedicel with distinct thumb; seta *e* of trochanter I stout and bladelike, at least twice width of other setae of leg; tarsi II and III each with four normal tactiles and two enormous basal tactiles, the latter sclerotized, rectangulate to clavate, serrate or armed with a prickle apically; solenidia of tibiae II and III present, arising at base of segment; pretarsi short, one-quarter the length of tarsi or less; claws II and III stout, with distinct basal dilation, claws IV lacking; pulvilli II and III extending distinctly beyond claws; coxa III elongate-subcordate in ventral aspect; coxa IV subquadrate; trochanter IV about half the length of coxa IV; femurogenu IV greatly reduced, bandlike, bearing one seta; tarsus IV greatly reduced, subequal to or shorter than tarsus III, not or only slightly attenuate; ratio of femurogenu IV to tarsus IV, 1:3.5 to 1:5.7.

DESCRIPTION OF GRAVID FEMALE. As described for non-gravid female except for the following: physogastric, shape greatly elongate, cylindrical or slightly clavate posteriorly, resembling small insect larva; length, 1000 to 1300μ, width, 220 to 300μ at widest point; venter to and including ventral insertions of the third tergosternal muscles, and dorsum up to and including second dorsal segment bulbose, slightly dilated, lightly sclerotized, resembling head capsule of larval insect, this area sometimes set off by a sclerotized band delimiting its posterior margin; body behind above region with series of seven to nine regularly spaced conjunctival pseudosegments, true dorsal segments three and four located in depressions between these pseudosegments; two to three pseudosegments between true dorsal segments II and III, three between III and IV, one to three plus terminal lobe posterior to dorsal segment IV; segment V located ventrally on terminal lobe; all pseudosegments, with occasional exception of terminal lobe, with one or more rows of spicules at least laterally, or spicules indistinct or absent; if present, spicules often of two distinct sizes, coarser most frequent on anteriormost and posteriormost pseudosegments but present ventrally on all pseudosegments, finer most common dorsally and on sides of middle pseudosegments; vagina between anterior and posterior vaginal sclerites well defined, forming a birth pore which appears as a posterior linear prolongation of posterior median apodeme when viewed in ventral aspect; ventral conjunctival pseudosternum surrounding vagina (oviporal plate) distinctly convex when viewed in profile.

HABITS. A more lengthy discussion of the habits of these mites will be published by C. W. Rettenmeyer of Kansas State University in a forthcoming paper concerned with the inquilines and parasites of Central American doryline ants. Certain aspects not stressed by that author and certain conclusions drawn from studies of comparative morphology and phylogeny of the species will be presented here.

A feature of members of the genus shared only with *Glyphidomastax* is found in the mouthparts. In these two genera the normally styliform chelicerae are vestigial, their functions almost certainly being assumed by the elongated and bladelike palps. Since the latter are movable, they may be spread after penetration of the host tissue to insure a more stable attachment during engorgement.

The structure and conformation of the gravid female differs markedly in several respects from those described for more primitive forms such as *Pyemotes* and proceeds longitudinally so that the gravid mite resembles a tiny coleopterous or dipterous larva.

Gravid females are found only with the larval ants (C. W. Rettenmeyer, *in litt.*). Their food is not known, but it is probable that they are parasites of ant larvae or eggs in the same manner as the females of *Acarophenax tribolii* and its tenebrionid hosts. It seems less likely that they are merely trespassers competing for food with the host larvae. In either event, the adaptive value of the larval mimicry is obvious.

Young (*i. e.*, non-gravid) adult females are phoretic upon worker ants. Males are unknown.

In the manner of *Siteroptes,* eggs in various stages of cleavage are found within the body of the female, some containing well-developed larvae. In no cases, however, were other stages found therein, which suggests that a free larval stage may occur. This inference is strengthened by the fact that the most highly developed larval embryos are found in the region of the muscular common oviduct, through which they probably leave the body. Because of the presence of this structure and of the early embryos surrounding it, a complete hysterosomal breakdown resulting in the mass release of eggs or larvae probably does not occur. Dissection of three specimens indicates that the number of fully developed larvae present within the female at any one time is small, six to ten, while the total number of mature eggs may reach forty or more. Additional eggs in different, earlier stages of development are also easily seen.

If a free-living larval stage exists, this stage must be completed within or near the ant brood during the statary phase of the ants' cycle or shortly thereafter since the young females ride upon the worker ants.

Nymphal stage(s) are thought to be absent, the larva molting directly to the adult as in other specialized Pyemotidae and Scutacaridae.

SPECIMENS EXAMINED. In addition to the type species, as follows: PANAMA (Canal Zone): Barro Colorado Island, March 1-June 17, 1955, M. E. and C. W. Rettenmeyer, 50 non-gravid females from *Eciton burchelli* (Westwood) and *E. hamatum* (Fabricius). Same locality and collectors, August 7, 1956, 8 gravid females from *E. burchelli.* Same locality and collectors, May 18, 1956, 1 non-gravid female from *Nomamyrmex esenbecki crassicornis* (Smith). The author has included only specimens from *E. hamatum* in the description of the type species but is aware that later study may show the form from *E. burchelli* to be conspecific with it. The single female from *N. esenbecki* is undoubtedly specifically distinct.

Perperipes ornithocephala, new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 220μ (207-231, $\bar{X} = 220.46 \pm$ S. E. 1.83); width, 201μ (193-212, $\bar{X} = 203.20 \pm$ S. E. 1.94); distance between anterior sternocoxal condyles III, 96μ (96-99, $\bar{X} = 97.27 \pm$ S. E. 0.42).

Gnathosoma. Length, —[27] (55-59, $\bar{X} = 57.60 \pm$ S. E. 0.68); width, —[27] (24-26, $\bar{X} = 24.75 \pm$ S. E. 0.03); distance between pal-

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[27] This measurement not possible on holotype.

pal setae about 20μ; external dorsals tiny, setiform, arising posterolaterad of internal dorsals by areolar diameter of latter.

Propodosoma. Dorsum. Distance between internal pseudostigmatal sockets, 85μ (85-102, $\bar{X} = 91.80$ ± S. E. 1.55); propodosomal seta nude, distinctly shorter than pseudostigmatal pedicel. *Venter.* Setae moderate in size, 23 to 36μ long, flagellate, nude or sparsely plumose, internals I only slightly longer and wider than externals I; internal ventrals II well anterior to externals and only slightly mesad of them, straight line drawn between externals I and externals II passing barely laterad of internals II; apodemes II evenly arcuate, continuing laterally around anterior margin of coxal foramina II.

Hysterosoma. Dorsum. All dorsal setae sparsely plumose; setae of first segment subequally spaced, dorsals arising slightly anterior to laterals, 63μ (63-70, $\bar{X} = 66.92$ ± S. E. 0.71) apart, 22μ (21-25, $\bar{X} = 22.24$ ± S. E. 0.20) long, laterals about four times as long; dorsals II only slightly longer than dorsals I, 96μ (96-108, $\bar{X} = 100.24$ ± S. E. 0.72) apart, located approximately above center of coxae III; dorsals III 66μ (66-80, $\bar{X} = 76.41$ ± S. E. 0.87) apart, 41μ (39-50, $\bar{X} = 41.76$ ± S. E. 0.58) long; laterals III in nearly transverse line with dorsals, submarginal, 100μ (96-107, $\bar{X} = 102.77$ ± S. E. 1.22) long; setae of segment IV in transverse row, dorsals 52μ (46-59, $\bar{X} = 48.00$ ± S. E. 0.43) apart, 116μ (111-119, $\bar{X} = 116.13$ ± S. E. 0.43) long; laterals IV submarginal, 127μ (120-130, $\bar{X} = 125.60$ ± S. E. 0.83) long; setae of segment V distinctly ventral, internal caudal 79μ (73-85, $\bar{X} = 80.13$ ± S. E. 0.75) long, external caudals I lacking, external caudal II arising posterior to internal caudal and about the width of one setal base laterad to it, 39μ (36-41, $\bar{X} = 38.45$ ± S. E. 0.48) long. *Venter.* All setae of posterior ventral plate nude or nearly so, flagellate, about 9 to 33μ long; first axillary well laterad of anterior sternocoxal condyle of coxa III; second axillary located at posterior third of foraminal margin of coxa III; external presternal short, less than half the length of internal presternal; internal poststernal arising about half way between anterior median apodeme and external poststernal and behind inferior termination of posterior median apodeme; external poststernal extending slightly less than half way to posteriormost margin of opisthosoma; opisthosomal venter without scalelike engravings, its posterior margin entire.

Legs (all measurements in μ). *Length.* Leg I, 46 (46-47, $\bar{X} =$

46.54 ± S. E. 0.15); leg II, 80 (77-83, $\bar{X} = 79.07$ ± S. E. 0.50); leg III, 87 (77-88, $\bar{X} = 81.64$ ± 1.02); leg IV, 85 (81-93, $\bar{X} = 85.31$ ± S. E. 0.70). *Width.* Leg I, 25 (15-28, $\bar{X} = 24.50$ ± S. E. 0.78); leg II, 37 (34-37, $\bar{X} = 36.00$ ± S. E. 0.26); leg III, 36 (35-39, $\bar{X} = 35.93$ ± S. E. 0.29); leg IV, 25 (24-29, $\bar{X} = 26.38$ ± S. E. 0.49). *Segment lengths.* Tr I, 19 (15-19, $\bar{X} = 16.38$); tita I, 20 (20-24, $\bar{X} = 22.19$ ± S. E. 0.25); ta II, 33 (29-33, $\bar{X} = 30.63$ ± 0.16); ti III, 14 (14-17, $\bar{X} = 14.75$ ± S. E. 0.19); ta III, 33 (29-35, $\bar{X} = 31.57$ ± S. E. 0.44); cx IV, 33 (30-36, $\bar{X} = 33.19$ ± S. E. 0.42); tr IV, 14 (14-18, $\bar{X} = 15.25$ ± S. E. 0.23); fege IV, 3 (3-8, $\bar{X} = 6.29$ ± S. E. 0.38); ta IV, 28 (24-30, $\bar{X} = 26.88$ ± S. E. 0.59). *Setation.* Leg I: cx 1T, tr 3T, fege 4T, tita 13T + 7S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4 T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T, ta 6T (only 3-5 usually visible).

Tibiotarsus I with four lateral clavate or bullet-shaped setae; solenidia of tibiae and tarsi II and III basal, often appearing to arise from preceding segments; solenidium of tarsus II moderately sized, clavate; anterior, enlarged, basal tactile with one large, median, apical tooth and two, tiny, pricklelike lateral teeth (or only large median tooth present); apex of posterior enlarged basal tactile seta similar, this seta not markedly clavate; coxa IV not bulbose basally; femurogenu IV bandlike, appearing only wide enough to bear stout seta; other segments of leg IV bearing very stout setae of which the external of the trochanter and the external of the tibia are longest, about 150μ; ventromedial seta of tibia IV nearly as broad but much shorter, about 105μ.

Distribution. Known only from the Republic of Panamá.

Type Material. Female holotype and sixteen female paratypes (none gravid) from Barro Colorado Island, Canal Zone, Panamá, June 16, 1956, C. W. and M. E. Rettenmeyer, from *Eciton hamatum*, Colony No. E-189.

Type Repositories. Holotype and twelve paratypes (nos. 3 to 14) in the Snow Entomological Museum, The University of Kansas. One paratype (no. 1) in the U. S. National Museum. One paratype, (no. 15) in the Zoologische Institut, Universität Erlangen, Erlangen, Germany, one paratype (no. 16) in the British Museum (Natural History), London, England, and one paratype (no. 2) in the private collection of C. W. Rettenmeyer, Kansas State University, Manhattan, Kansas.

SPECIMENS EXAMINED. PANAMA: Same data as type series, nine females. Pieer River, Darien Province, February 16, 1948, T. C. Schneirla, from *Eciton hamatum* in nomadic day 2 (Colony No. 148HD), 24 gravid females.

Neopygmephorini, new tribe

This tribe includes four genera whose interrelationships are unclear. Three of these groups seemingly possess no entirely unique characters and are therefore difficult to characterize although group differences are obvious upon careful inspection. The fourth genus, *Acinogaster*, is easily distinguishable from the others although it is more closely related to (and is probably an "exgroup" of) *Parapygmephorus* than any of the other genera are to each other.

Members of the tribe are thought to be among the most highly specialized forms of the Pyemotidae and to be ancestral to the family Scutacaridae.

DIAGNOSIS. Females easily separable from those of other Pygmephorinae in that seta *c* is always modified bladelike, its apex often proflexed, and in having one or (usually) two but never three pairs of propodosomal dorsals.

DESCRIPTION OF NON-GRAVID FEMALE. *Gnathosoma.* Usually quadrate, occasionally longer than wide; palps palmate to subpalmate, with one or more distinct apical teeth, never greatly elongate, not fitted for piercing; ventral esophageal-pharyngeal pump absent; chelicerae distinct or not, if so then small, aciculate; esophagus not distinctly coiled between pharynx and esophageal "finned structures."

Propodosoma. Dorsum. With one (rarely) or two pairs of setae, if two pairs, both distinctly visible; peritremes widely separated, usually circular, rarely elongate or guttate; esophageal "finned" structures distinct or not, varying in number. *Venter.* Anterior ventral plate with four pairs of setae; external ventrals I furcate or not.

Hysterosoma. Dorsum. First hysterosomal tergum enlarged anteriorly to cover entire propodosomal dorsum or (usually) not, if so, then margins neither projecting free nor with radial striations; segment V with two (rarely) or three pairs of setae; posterior portion of vaginal wall often sclerotized but lacking globose to elliptical pumplike enlargements; posterior genital sclerite usually triangular and flaplike, often broadly so. *Venter.* Posterior ventral plate entire, its hind margin rarely tripartite; apodemes V absent.

Legs. Leg I articulated obliquely (usually) or at a right angle to the longitudinal axis of body, size variable; claw I usually present, only rarely sessile (in some *Sicilipes*); mediolateral sclerotized area of tibiotarsus I usually present; trochanter I with three setae, seta *c* semimembranous, bladelike, its apex usually distinctly proflexed; piannacula of tibiotarsus I present or absent.

Key to the Genera of the Tribe Neopygmephorini (Females)

1(*a*). First and second axillaries and internal ventrals I and II greatly enlarged, compressed, variously clavate to acuminate *Acinogaster*, new genus, p. 214

1(*b*). First and second axillaries and internal ventrals I and II setiform....2

2(*a*). Coxa IV broadly constricted about two-thirds of distance from apex, base rounded, bulbose, or, if (rarely) constriction not distinct, then legs long and thin, trochanter IV at least 2.5 times as long as wide (if less than 2.7 times, then trochanter III at least 2.5 times as long as wide); leg I thinner,[28] usually shorter than leg II *Neopygmephorus*, new genus, p. 225

2(*b*). Coxa IV only rarely constricted and bulbose basally, if so then claw I sessile or leg I at least as wide as leg II..........................3

3(*a*). With the following combination of characters: leg I at least as wide as leg II; longitudinal distance between internal presternal and external presternal always equal to or greater than transverse distance between external presternal and first axillary *Pseudopygmephorus*, new genus, p. 221

3(*b*). Leg I usually distinctly thinner and shorter than leg II, if as wide then longitudinal distance between internal presternal and external presternal distinctly less than transverse distance between external presternal and first axillary...................*Parapygmephorus*, new genus, p. 197

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[28] As measured at apex of trochanter.

Parapygmephorus, new genus

This genus contains a number of morphologically heterogeneous but intergrading forms, the most primitive of which resemble closely and are presumably closely related to *Pygmephorus.* More specialized forms (*Parapygmephorus s. str.*) closely resemble *Neopygmephorus.* In this paper, the latter genus is considered to be an "exgroup" of *Pseudopygmephorus* for reasons stated elsewhere, and the many morphological similarities between *Parapygmephorus* and *Neopygmephorus* are considered to have been derived independently. The arrangement of apodemes IV and of the external presternals, the shape and size of the stigmata, and the occasional presence in both groups of characters universal to the other are instances of such parallelism.

Ecologically, species of *Parapygmephorus* tend to differ from those of *Neopygmephorus*, being usually associated with Hymenoptera, although one form in the author's collection is found with termites and several species are recorded from decayed wood or sphagnum. It is possible that the latter were dislodged from insects during the processes of collecting and sorting.

The genus is here divided into three subgenera, of which *Sicilipes* is considered the most primitive and *Petalomium* the most specialized. Only the females are known.

DIAGNOSIS. Females may be separated from those of *Pseudopygmephorus* because the longitudinal distance between the internal and the external presternal is distinctly less than that between the external presternal and the first axillary. In addition, leg I is shorter and usually thinner than leg II. If (rarely) it is as wide, then claw I is enlarged, opposed by a stout thumb, and tibiotarsus I has a distinct, circular, dorsal, mediolateral sclerotized area. They are distinguished from those of *Neopygmephorus* in that coxa IV is not distinctly constricted at its basal third, or if so, then claw I is sessile.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 130 to 430μ; width, 70 to 240μ; width between anterior sternocoxal condyles III, 55 to 140μ; hysterosoma ovate, sometimes broadly so; body very weakly to heavily sclerotized, rarely with scalelike integumental engravings; coarse punctae and striae usually absent on most lateral portions of posterior ventral plate.

Gnathosoma. Variously shaped, normally directed ventrally or posteroventrally; solenidium II usually greatly enlarged.

Propodosoma. Dorsum. Inversely T-shaped to broadly trapezoidal; anterior portion of dorsum prolonged hoodlike over gnathosoma, lateral margins of circumgnathosomal foramen thickened to form collar or not; posterior one-fourth to posterior three-fourths covered by first hysterosomal tergum; pseudostigmata located in posterior half; two pairs of propodosomal setae; peritremes large and circular or smaller, transversely ovoid, their mesal margins usually broken or emarginate because of stigmatal openings; peritremes located in anterior two-thirds of propodosoma or, rarely, in propodosomal "shoulders"; esophageal "finned" structures distinct or not visible, if distinct, then fins erect, close together. *Venter.* Internal ventral I arising anterior or posterior to external ventral I; internal ventral II not to distinctly anterior to external ventral II and much closer to it than to anterior median apodeme; external ventrals I forked or not; coxa I articulating at nearly a right angle to the longitudinal axis of body or (usually) distinctly obliquely; apodemes II variable, absent to strongly developed, usually incomplete, strongly arcuate or slightly W-shaped if present; secondary transverse apodeme present or absent, if present, then usually distinct only at sides and continued as thickening mesally; anterior median apodeme weakly to strongly developed, complete or not; posterior marginal apodemes straight, gently arcuate, or lyrate, usually strong, especially at the sides; distinct, pleated conjunctival band present or absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment overlapping posterior one-fourth to posterior three-fourths of propodosoma; fifth segment with three pairs of setae, these apical or apicoventral, or occasionally one pair well ventral; vulva apical or apicoventral; vagina enclosed apically by sclerotized, globose to elliptical pumplike enlargement or vagina merely sclerotized apically or soft and indistinct; posterior genital sclerite varying, irregular to triangular and flaplike in shape; median genital sclerite present or not. *Venter.* Posterior ventral plate with six pairs of setae, its hind margin entire, straight, broadly emarginate, or rarely trilobate; position of external presternals variable; external poststernals present, always arising from or close behind (at most half basal width of coxa IV, usually less) posteromesal sclerotization of fourth coxal foramina; apodemes III and IV variable in structure and definition; posterior median apodeme variable in extent and definition; band of opisthosomal conjunctival pleats usually absent, rarely well developed; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV; opisthosomal venter lacking integumental engravings.

Legs. Legs elongate or not, usually quite stout, ratio of length to width of trochanter IV, 1:1.2 to 1:3.0, rarely over 1:2.5; leg I distinctly shorter and usually thinner than leg II; tibiotarsus I usually elongate, about one and one-half times to twice as long as wide, distinctly wider than femurogenu I or not; pinnacula present or absent; mediolateral sclerotized area present or not, if present varying in shape and location; claw I dilate basally, variable in size, sessile (rarely) or pedicellate, pedicel usually broad and constricted basally, if present; thumb variable in size; apical portion of seta *c* of trochanter I proflexed or not; tarsi II and III each with six tactiles; solenidia of tibiae II and III present; pretarsus IV usually short, rarely a third as long as tarsus IV; claws II and III with large basal dilations, claw IV simple, usually reduced; pulvilli II to IV well developed, at least slightly longer than claws; coxa III elongate-subcordate to subcordate as viewed in inner ventral aspect, distance between anterior and posterior sternocoxal articulations 22 to 42μ; coxa IV short-rectangulate to rectangulate, basal third not to (rarely) distinctly constricted, basal fifth not to (rarely) distinctly bulbose, if distinctly constricted and bulbose then claw I sessile; ratio, length to width of coxa IV, 1:1.3 to 1:2.3, usually between 1:1.8 and 1:2.0; trochanter IV usually shorter than coxa IV; tarsus IV always distinctly longer than tarsus III, usually elongate and rather evenly attenuate, if short, then constricted abruptly basad of pretarsus; ratio of femurogenu IV to tarsus IV 1:2.9 to 1:10.5.

Key to the Subgenera of *Parapygmephorus* (Females)

1(*a*). External ventrals I of anterior ventral plate bi- or trifurcate; solenidium II arising from apex of tibia II; tibiotarsus I usually with distinct pinnaculum which is at least twice as long as wide
Petalomium, new subgenus, p. 209

1(*b*). External ventrals I of anterior ventral plate not furcate; solenidium II rarely on apex of tibia II, usually in normal position or (rarely) arising from tibiotarsal conjunctiva; tibiotarsus I lacking pinnaculum which is at least twice as long as wide 2

2(*a*). Tibiotarsus I always distinctly wider than femurogenu I, with dorsal, circular, mediolateral sclerotized plate; claw I moderate to large, sessile or borne on short pedicel which is as wide or wider than long; external presternals arising from apodomes IV or nearly so; secondary transverse suture of anterior ventral plate absent
Sicilipes, new subgenus, p. 200

2(*b*). Tibiotarsus I usually not or only slightly wider than femurogenu I, usually lacking dorsal, circular, mediolateral sclerotized plate—if distinctly wider and plate dorsal and circular, then either external presternals arising well anterior to apodemes IV or secondary transverse suture of anterior ventral plate present; claw I small to moderate, borne on pedicel which is as long or longer than wide
Parapygmephorus, sensu stricto, p. 205

Sicilipes, new subgenus

(Figs. 81-83)

Type, *Parapygmephorus* (*Sicilipes*) *halictinis*, new species.

This subgenus seemingly stands phylogenetically between *Pygmephorus* and *Parapygmephorus, s. str.*, and, with certain *Pseudopygmephorus*, is considered to contain the least specialized forms in the tribe Neopygmephorini.

Three undescribed species have been seen, two of which are phoretic upon bees. The third is found in woodland leaf litter. Only the non-gravid females are known.

DIAGNOSIS. Females easily separable from those of *Petalomium* in lacking pinnacula, because the tarsal solenidium of leg II is basal, and because external ventrals I are not forked. They are separable from *Parapygmephorus* by the following combination of characters: tibiotarsus I distinctly wider than femurogenu I and possessing a dorsal, circular, mediolateral, sclerotized plate; external presternals arising from or barely in front of apodemes IV; secondary transverse suture of anterior ventral plate absent.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 190 to 225µ; width, 115 to 130µ; width between anterior sternocoxal condyles III, 80 to 100µ.

Gnathosoma. Quadrate or distinctly broader than long.

Propodosoma. Dorsum. Inversely T-shaped; distance between internal pseudostigmatal sockets distinctly greater than length of propodosomal dorsum; foraminal collar distinct; posterior margin to posterior one fourth covered by first hysterosomal tergum; pseudostigmata located in posterior one fourth; peritremes without conspicuous rim, circular, widely separated, their mesal margins not distinctly emarginate, located in anterior half of dorsum or in propodosomal "shoulders"; if esophageal "finned" structures distinct, then posterior one enlarged, globose to elliptical, more prominent than elongate, cylindrical structure which precedes it, fins erect and straight, those of posterior structure much finer than those of anterior. *Venter.* Internal ventrals I arising anteriorly to external ventrals I; internal ventrals II only slightly anterior to external ventrals II, slightly to distinctly closer to them than to anterior median apodeme; external ventrals I not furcate; apodemes II weak or absent, if present, arcuate and usually complete; secondary transverse apodeme absent; anterior median apodeme usually strongly developed, complete; posterior marginal apodeme straight or nearly so.

Hysterosoma. Dorsum. First segment overlapping posterior margin to posterior one fourth of propodosomal dorsum; vulva apical; apical wall of vagina often distinctly sclerotized; posterior genital sclerite variously shaped but never triangular and flaplike; median genital sclerite absent. *Venter.* Hind margin of posterior ventral plate usually broadly emarginate; external presternals always arising from apodemes IV or less than one areolar diameter in front of them; apodemes III distinct or not, if distinct usually recurved at the sides to join anterior margins of coxal foramina III;

apodemes IV weakly to strongly developed, directed toward or joining coxal foramina III either at top quarter or recurving posteriorly to meet margin behind center; apodemes IV joining posterior median apodeme on or behind line drawn between anterior quarters of coxal foramina III; portion of posterior median apodeme behind apodemes IV about as long as or slightly longer than portion anterior to apodemes IV.

Legs. Ratio of length to width of trochanter IV, 1:2.1 to 1:2.4; leg I thinner than or as wide as leg II; tibiotarsus I usually about one and one-half times as long as wide, always much wider than femurogenu I; pinnacula absent; mediolateral sensory area present, enlarged and circular dorsally; claw I moderate to large in size, if pedicellate, pedicel as wide as or wider than long; thumb moderately to greatly enlarged; apical portion of seta *c* of trochanter I sharply proflexed; basal solenidium of tarsus II in normal position; pretarsus IV never nearly a third the length of tarsus IV; coxa IV subcordate when viewed in inner ventral aspect, distance between anterior and posterior sternocoxal articulations 22 to 30μ; trochanter IV subequal to coxa IV in length; tarsus IV moderately elongate, stout basally, tapering evenly to pretarsus or becoming suddenly constricted in apical half; ratio of femurogenu IV to tarsus IV, 1:3.5 to 1:5.0.

HABITS. Nothing is known of the habits of these mites.

SPECIMENS EXAMINED. In addition to the type species, as follows: *Species No. 1.* Highlands Hammock State Park, Florida, 1 ♀, leaf litter in low woods (berlese sample). *Species No. 2.* Moctezuma, Chihuahua, Mexico, 3 ♀ ♀ from thorax of ♀ *Agapostemon* sp. (Apoidea).

Parapygmephorus (*Sicilipes*) *halictinis*, new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 220μ (210-220, $\bar{X} = 215.86$); width, 131μ (115-131, $\bar{X} = 126.85$); distance between anterior sternocoxal condyles III, 85μ (85-88, $\bar{X} = 86.40$); body well sclerotized, coarsely punctate, punctae most noticeable on entire hysterosomal dorsum and opisthosomal venter, discs of terga I to III with jagged, shingled engravings besides.

Gnathosoma. Length, 25μ (22-25, $\bar{X} = 23.40$); width, 28μ (23-28, $\bar{X} = 24.17$); external dorsals less than half as long as internals, well posterior to and slightly laterad of them; anterior and posterior palpal setae only three to four μ apart; palp with single, greatly enlarged, mesally directed apicoventral tooth; palpal solenidium II greatly enlarged, cylindrical, solenidium I tiny, acuminate.

Propodosoma. Dorsum. Inversely T-shaped, anteriormost portion distinctly bulbose; peritremes circular, dorsal, located in anterior one quarter; distance between internal pseudostigmatal sockets 48μ (44-52, $\bar{X} = 47.14$); anterior pseudostigmatal seta short, nude, 16μ (11-16, $\bar{X} = 14.50$), arising immediately anteromesad of external pseudostigmatal socket, posterior pseudostigmatal seta arising posteromesad, very long, 63μ (57-63, $\bar{X} = 58.00$), sparsely plumose. *Venter.* All setae flagellate, sparsely plumose, 33 to 46μ long; internal ventral II longer than external II, only slightly anterior to it; lateral and ventral margins of circumgnathosomal foramen greatly thickened, forming a distinct gnathosomal collar; apodemes II absent or indistinct.

Hysterosoma. Dorsum. All dorsal setae stout, long, sparsely plumose; setae of first segment in transverse row or nearly so, dorsals 41μ (41-47, $\bar{X} = 42.50$) long, 52μ (52-57, $\bar{X} = 54.29$) apart; laterals I 88μ (85-93, $\bar{X} = 87.83$) long, much closer to respective dorsals than dorsals to each other; dorsals II separated by one of their own lengths, 47μ (42-51, $\bar{X} = 46.57$) long; dorsals III arising approximately directly behind dorsals II, 50μ (48-53, $\bar{X} = 50.71$) long, laterals III about two areolar diameters posterolaterad, more slender than but about as long as dorsals; dorsals IV 60μ (57-62, $\bar{X} = 59.57$) long, only 19μ (19-22, $\bar{X} = 20.43$) apart, laterals IV nearly that same distance posterolaterad, subequal in length to dorsals; setae of segment V thin, flagellate, sparsely plumose, arising distinctly from the venter, internal caudals shortest, 19μ (17-20, $\bar{X} = 18.14$) long, arising well anteromesad of external caudals; external caudals I 28μ (25-31, $\bar{X} = 27.86$) long, much closer to internal caudals than to external caudals II and subequal to or slightly longer than the latter. *Venter.* All setae of posterior ventral plate flagellate, 20μ (1st axillaries) to 50μ (external poststernals) long; first axillaries barely anterior of line drawn between anteriormost margins of coxal foramina III, nearly in transverse line with internal presternals; external presternals well behind and distinctly mesad of internal presternals; external poststernals arising distinctly anteriorly to line drawn between posteromesal margins of coxal foramina IV; apodemes III indistinct; apodemes IV indistinct or distinct only laterally, joining coxal foramina behind middle; posterior margin of opisthosomal venter broadly and shallowly emarginate (to broadly rounded).

Legs (all measurements in μ). *Length.* Leg I, 55 (54-57, $\bar{X} = 55.43$); leg II, 69 (64-70, $\bar{X} = 68.17$); leg III, 74 (70-85, $\bar{X} = 75.17$); leg IV, 126 (118-128, $\bar{X} = 124.86$). *Width.* Leg I, 19 (15-19,

$\bar{X} = 17.14$); leg II, 19 (14-19, $\bar{X} = 17.43$); leg III, 17 (13-17, $\bar{X} = 14.43$); leg IV, 15 (13-15, $\bar{X} = 13.86$). *Segment lengths.* Tr I, 21 (19-21, $\bar{X} = 20.14$); tita I, 24 (24-28, $\bar{X} = 25.71$); tr II, 24 (23-24, $\bar{X} = 23.71$); ta II, 25 (22-25, $\bar{X} = 23.67$); tr III, 24 (24-28, $\bar{X} = 26.57$); ti III, 13 (13-14, $\bar{X} = 13.29$); ta III, 26 (25-28), $\bar{X} = 26.20$); cx IV, 29 (25-30, $\bar{X} = 28.00$); tr IV, 26 (26-30, $\bar{X} = 28.29$); fege IV, 12 (9-12, $\bar{X} = 10.29$); ta IV, 41 (37-42, $\bar{X} = 40.86$). *Setation.* Leg I: cx 1T, tr 1T + 2 modified, fege 4T, tita 12T + 8S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Seta *c* of trochanter I sharply proflexed, seta *d* longer but bladelike, undulate; solenidium 3 of tibiotarsus I short, acuminate, solenidium 4 laterad of it, less than a third as long, clavate; tibial solenidia of legs II and III arising from basal third, small, clavate; tarsal solenidium of leg II resembling solenidium 3 of first leg but smaller; coxa IV short-rectangulate, evenly dilate toward the base, ratio of length to width 1:1.3 to 1:1.6; tarsus IV constricted abruptly in apical half; ratio of femurogenu IV to tarsus IV 1:3.4 to 1:4.7; claw IV simple but well developed, not greatly smaller than claw III.

HABITS. Nothing is known of the habits of this species. The non-gravid females are found, often in huge masses, on the anterior face of the first metasomal tergum of the halictine bee *Agapostemon virescens* (Fabricius). Occasional stragglers may be found on the discs of the metasomal terga, on the posterior face of the propodeum, in the mesothoracic spiracular openings, etc. It is probable, in consideration of the numbers of mites involved, that these are acquired by the bee while she is yet in the burrow.

DISTRIBUTION. Known only from Summit County, Ohio, and Tippecanoe County, Indiana.

TYPE MATERIAL. Female holotype from Summit County, Ohio, July 3, 1934, L. J. Lipovsky, from *Agapostemon virescens* (Fabricius). Five female paratypes (nos. 1-5) from Lafayette, Tippecanoe County, Indiana, July 5, 1932, collector unknown, from *Agapostemon virescens.*

TYPE REPOSITORIES. Holotype and two paratypes (nos. 1 and 3) in the Snow Entomological Museum, The University of Kansas, one paratype (no. 2) in the Purdue Entomological Collections, Purdue University, one paratype (no. 4) in the U. S. National Museum, Washington, D. C., and one paratype (no. 5) in the Zoologisches Institut, Universität Erlangen, Erlangen, Germany.

SPECIMENS EXAMINED. In addition to the type material as follows: Lafayette, Indiana, August 25, 1939, collector unknown, numerous females from *A. virescens.* Same, July 25, 1921, and September 28, 1921.

Subgenus *Parapygmephorus, sensu stricto*

(Figs. 87-89)

Type, *Paragymephorus* (*Parapygmephorus*) *natalensis,* new species.

This subgenus includes a rather heterogeneous group of forms, the largest division of which is phoretic upon and perhaps parasitic upon certain African and Asian species of the apoid subfamily Nomiinae. Other species are associated with other halictine bees, with termites, and with ants. Members of the subgenus exhibit fewer specialized characters than do those of the subgenus *Petalomium* and are most closely related to members of the subgenus *Sicilipes.*

DIAGNOSIS. Females separable from those of *Sicilipes* and *Petalomium* by the characters given in the subgeneric key.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 130 to 430μ; width, 70 to 240μ; distance between anterior sternocoxal condyles III, 55 to 125μ; body often with coarse punctae; hysterosomal dorsum occasionally with scalelike integumental engravings.

Gnathosoma. Quadrate to distinctly longer than wide; palpal solenidium II usually clavate; esophagus usually distinct, occasionally with small "bow-tie" finned structure.

Propodosoma. Dorsum. Inversely T-shaped to nearly rectangulate, usually poorly developed behind pseudostigmatal sockets; distance between internal pseudostigmatal sockets usually slightly less than, rarely more than length of propodosoma; foramen usually anteroventrad, rarely ventrad, foraminal collar usually distinct laterally; pseudostigmata located in posterior third; peritremes circular, rarely somewhat ovoid, located in middle third of dorsum; from one to three "finned" structures usually distinct,[29] if so then posterior one subglobose, not enlarged or more prominent than one preceding, latter elongate, often greatly so. *Venter.* Internal ventrals I usually arising distinctly anterior to, rarely posterior to external ventrals I; internal ventrals II slightly to distinctly anterior to external ventrals II; external ventrals I not furcate; coxa I attached at an oblique angle to longitudinal axis of body; anterior median apodeme usually strongly developed and complete.

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[29] If three present, one usually in gnathosoma, two in propodosoma.

Hysterosoma. Dorsum. First segment overlapping posterior one fourth to one third of propodosoma; setae of fifth segment apical or apicoventral; vulva usually enclosed in genital sulcus; apical portion of vaginal wall usually sclerotized, sometimes thickly so. *Venter.* Hind margin of posterior ventral plate straight, broadly emarginate, undulate, or rounded; external presternals arising on to well anterior of apodemes IV; distance between external presternals always greater than that between internal presternals; external poststernals arising half the basal width of coxa IV or less behind line drawn between posteromesal margins of coxal foramina IV; apodemes III indistinct to distinct, curving posteriorly at the sides to join anterior sternocoxal condyles of coxae III or not; apodemes IV usually joining, always extending at least three-quarters of distance to coxal foramina III; apodemes IV directed toward or joining margins of coxal foramina III at varying points, joining posterior median apodeme on or anterior to line drawn between centers of coxal foramina III; portion of posterior median apodeme behind apodemes IV about four-fifths to one and three-quarters times as long as that anterior to apodemes IV.

Legs. Leg I distinctly shorter and thinner than leg II; tibiotarsus I variable in length, usually about twice as long as wide, as wide as or distinctly wider than femurogenu I; pinnacula absent or reduced, height never nearly twice apical width; mediolateral sclerotized plate variously developed, indistinct, irregular and marginal, or becoming enlarged and circular dorsally; claw I moderate to large in size, pedicellate, pedicel usually about as long as wide; thumb weakly to strongly developed; apical portion of seta *c* of trochanter I usually strongly proflexed; tarsal solenidium of leg II usually arising from base of tarsus but occasionally from tibiotarsal conjunctiva or from tibial apex; pretarsus IV never nearly a third the length of the tarsus; basal third of coxa IV not or only slightly constricted, not or only weakly bulbose basally; ratio of length to width of coxa IV, 1:1.3 to 1:2.1; ratio of femurogenu IV to tarsus IV, 1:2.9 to 1:6.8.

Species thought to belong in *Parapygmephorus, s. str.:*

?*chaetosus* (Krczal, 1959) (*Pygmephorus*)

HABITS. Nothing is known of the habits of the species included herein. To judge by the presence of bands of pleated conjunctiva, extreme physogastry may occur in at least two species associated with bees. Host preferences are similar to those of the other subgenera, five of the ten species seen by the author being from bees, two from ants, one from termites, one from decayed wood, and one from "under rock."

SPECIMENS EXAMINED. In addition to the type series as follows: nine species from the central United States and from Brazil, Panamá, Mexico (San Luis Potosí), Phillippines (Luzon), and Africa, from the following situations or hosts: *Neivamyrmex legionis* (F. Smith), *N. gibbatus* Borgmeier, *Nomamyrmex esenbecki* (Smith) (all Formicidae, Dorylinae), *Nomia* sp., *Nomia philippinensis* Cockerell, *Augochlora* sp. (all Apoidea, Halictidae), from under rock, in decayed wood, from workers of *Reticulitermes flavipes* (Kollar) (Isoptera).

Parapygmephorus (*Parapygmephorus*) *natalensis*, new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 270μ (257-282, $\bar{X} = 269$); width, 165μ (162-165, $\bar{X} = 164$); distance between anterior sternocoxal condyles III, 123μ (123-126, $\bar{X} = 125$); body moderately sclerotized, coarsely punctate, punctae most noticeable on propodosomal dorsum and especially on discs of hysterosomal terga I to IV; other integumental markings absent.

Gnathosoma. Length, 37μ ($\bar{X} = 37$); width, 36μ (31-36, $\bar{X} = 34$); external dorsals about three-quarters as long as internals, distinctly more laterad of them than posterior to them; postpalpals spiniform, slightly anterior to internal and slightly laterad of external dorsals; anterior and posterior palpal setae about 5μ apart; palp with distinct apical inner tooth; palpal solenidium I clavate, about half as long as II.

Propodosoma. Dorsum. Inversely T-shaped, anteriormost portion distinctly bulbose; peritremes large, circular (or nearly so), dorsal, located about half way between anterior and posterior margins of propodosoma, rather indistinct; stigmatal openings more prominent than peritremes, guttate; distance between internal pseudostigmatal sockets 55μ (55-58, $\bar{X} = 56$); anterior pseudostigmatal setae nude, short, 11μ (11-12, $\bar{X} = 11$) long, well anteromesad of internal pseudostigmatal socket, posterior pseudostigmatals elongate, 62μ (62-69, $\bar{X} = 66$), sparsely plumose, arising on line drawn between internal pseudostigmatal sockets (or nearly so). *Venter.* All setae flagellate, sparsely plumose; ventrals I subsequal in size, about 35 to 40μ long; internal ventrals II elongate, about 58 to 63μ, externals II only about half as long, arising distinctly posterior to internals; lateral and ventral margins of circumgnathosomal foramen greatly thickened, forming gnathosomal collar; apodemes II distinct, arcuate, terminating at point of origin of external ventrals I; secondary transverse apodemes present, meeting apodemes II medially.

Hysterosoma. Dorsum. All dorsal setae stout, elongate (some greatly so), sparsely plumose; setae of first segment in transverse row, dorsals 52μ (52-59, $\bar{X} = 56$) long, 63μ (63-68, $\bar{X} = 65$) apart; laterals I 163μ (160-163, $\bar{X} = 161$) long, much closer to respective dorsals than dorsals to each other; dorsals II 61μ (61-70, $\bar{X} = 67$) apart, 56μ (56-63, $\bar{X} = 59$) long; dorsals III arising nearly directly behind dorsals II, 63μ (63-75, $\bar{X} = 69$) apart, 143μ (143-157, $\bar{X} = 148$) long, laterals III arising about two areolar diameters posterolaterad, only 30μ (30-35, $\bar{X} = 32$) long; dorsals IV 97μ (79-105, $\bar{X} = 101$) long, only 43μ (43-48, $\bar{X} = 46$) apart, laterals IV barely anterior to and about three areolar diameters laterad of them, 74μ (74-83, $\bar{X} = 80$) long; setae of segment V much smaller than those of preceding segments, arising distinctly from ventral surface; internal caudals and external caudals I arising in transverse line, their areoli contiguous or nearly so; external caudals II about three areolar widths anteroventrad of internal caudals; length of internal caudals, 42μ (40-42, $\bar{X} = 41$), of external caudals I, 31μ ($\bar{X} = 31$), of external caudals II, 17μ (17-18, $\bar{X} = 18$). *Venter.* All setae of posterior ventral plate well developed, flagellate, 30 (internal presternals) to 48μ (external presternals) long; first axillary distinctly behind internal presternals but well anterior to line drawn between anteriormost margins of coxal foramina III; external presternals well behind and distinctly laterad of internal presternals, arising about one areolar diameter anterior to apodemes IV, external poststernals half the basal width of coxa IV behind line drawn between posteromesal margins of coxal foramina IV; apodemes III distinct, at right angles to longitudinal axis of body, extending laterad to longitude of first axillaries; apodemes IV distinct, joining mesal margins of coxal foramina III at or slightly behind their centers; distinct band of conjunctival pleats present (or band indistinct) ventrally beneath posterior ventral plate, dorsally between segments III and IV; vulvar sulcus present; posterior genital sclerite elongate, triangular and flaplike.

Legs (all measurements in μ). *Length.* Leg I, 91 (91); leg II, 129 ($\bar{X} = 129$); leg III, 144 (142-146, $\bar{X} = 144$); leg IV, 203 (201-203, $\bar{X} = 202$). *Width.* Leg I, 24 (23-25, $\bar{X} = 24$); leg II, 25 (25-30, $\bar{X} = 27$); leg III, 24 (24-25, $\bar{X} = 24$); leg IV, 16 (16-22, $\bar{X} = 19$). *Segment lengths.* Tr I, 21 (21-33, $\bar{X} = 26$); tita I, 47 ($\bar{X} = 47$); tr II, 44 (43-44, $\bar{X} = 44$); ta II, 48 (46-48, $\bar{X} = 47$);

tr III, 51 (51-54, $\bar{X} = 52$); ti III, 25 (24-25, $\bar{X} = 25$); ta III, 52 (50-55, $\bar{X} = 52$); cx IV, 46 (46-50, $\bar{X} = 47$); tr IV, 47 (44-49, $\bar{X} = 47$); fege IV, 17 (15-17, $\bar{X} = 16$); ta IV, 68 (67-68, $\bar{X} = 68$). *Setation.* Leg I: cx 1T, tr 2T + 1 modified, fege 4T, tita 11T + 9S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 1S, ta 6T + 1S; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Seta *c* of trochanter I sharply proflexed, seta *d* also short and bladelike; solenidium 3 of tibiotarsus I about nine μ, attenuate, apex rounded; solenidium 4 slightly more than half as along as 3, rodlike; solenidia 1 and 2 not over eight μ; tibiotarsus I elongate, slightly wider than femurogenu; tibial solenidia of legs II and III about five μ, weakly clavate, tarsal solenidium of leg II about seven μ, peglike; coxa IV rectangulate, ratio of length to width about 1:1.6 to 1:1.8; ratio, length to width of trochanter III about 1:2.1; tarsus IV evenly attenuate apically, 68μ (67-68, $\bar{X} = 68$) long; ratio of femurogenu IV to tarsus IV about 1:4.0 to 1:4.5; ratio, length to width of trochanter IV about 1:2.2 to 1:2.9.

Habits. Nothing is known of the habits of this species. The non-gravid females were taken from the body of the African nomiine bee *Crinoglossa natalensis* Friese.

Distribution. Known only from the type locality.

Type Material. Female holotype and two female paratypes (nos. 1 and 2) from Bluff, Natal, Africa, 9-3-14, collector unknown, from *Crinoglossa natalensis* Friese.

Type Repositories. Holotype and one paratype (no. 1) in the Snow Entomological Museum at The University of Kansas, remaining paratype in the U. S. National Museum, Washington, D. C.

Petalomium, new subgenus

(Figs. 84-86)

Type, *Parapygmephorus* (*Petalomium*) *krczali*, new species.

This subgenus includes at least a dozen species, most of which are associated with ants. Its members are considered to be highly specialized, as indicated by the characters given below.

Diagnosis. Females separable from those of the remaining subgenera in that the body is broadly oval, the propodosoma likewise broad, in that external ventral I is furcate, in possessing one or two median genital sclerites, because tibiotarsus I usually has a well developed pinnaculum, and in the disproportionate elongation of leg IV, particularly of the tarsus and pretarsus.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 210 to 330μ; width, 145 to 225μ; width between anterior sternocoxal condyles of coxae III, 95 to 145μ; body weakly sclerotized, lacking integumental engravings and usually without coarse punctae.

Gnathosoma. Quadrate or but little longer than wide.

Propodosoma. Dorsum. Broad, distance between internal pseudostigmatal sockets at least slightly, usually much greater than length of dorsum; peritremes with mesal margins emarginate, located in middle third of dorsum; esophageal "finned" structures usually indistinct, single and small to medium in size if distinct. *Venter.* Internal ventrals II slightly to distinctly anterior to external ventrals II; external ventrals I always distinctly forked, bi- or trifurcate; coxa I articulated at oblique angle to longitudinal axis of body; apodemes II arcuate, weak, terminating laterally at areolus of external ventrals I, usually incomplete medially; secondary transverse suture absent; posterior marginal apodemes straight or gently arcuate; distinct, pleated, conjunctival band absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. Setae of fifth segment apical or apicoventral; vulva apical; apical portion of vaginal wall usually sclerotized and distinct, but enlarged, globose to elliptical sclerotization absent; posterior genital sclerite usually triangular and flaplike, rarely indistinct; one or (rarely) two median genital sclerites present, irregular or rounded in shape. *Venter.* External presternals arising on to well anterior of apodemes IV; apodemes III usually indistinct, if distinct, never bending posteriorly at sides; apodemes IV usually extending at least three-quarters of distance to coxal foramina III, rarely less, or indistinct; apodemes IV directed toward or joining coxal foramina III at anterior third or quarter, joining posterior median apodeme on or posterior to line drawn between anterior sternocoxal condyles of coxae III; posterior median apodeme variable, portion behind apodemes IV three-quarters to one and three-quarters times as long as that anterior to apodemes IV; well defined band of opisthosomal conjunctival pleats absent.

Legs. Ratio, length to width of trochanter IV, 1:1.2 to 1:2.3; leg I distinctly to greatly shorter than, always thinner than leg II; tibiotarsus I at least twice as long as wide, subequal to distinctly wider than femurogenu I; pinnacula present or vestigial, if present well developed, twice as long as width at apex; medio-lateral sensory area present or absent, if present, then marginal and irregular in shape, never distinctly circular dorsally; claw I moderate in size, pedicellate, pedicel variable in size, thumb absent or moderately developed; apical portion of seta *c* of trochanter I not or barely proflexed; basal solenidium of tarsus II arising distinctly from apex of tibia; pretarsi II and III short, usually one-quarter the length of the tarsus or less; pretarsus IV often distinctly elongate but never more than one-third length of tarsus; coxa III elongate-subcordate when viewed in inner ventral aspect, distance between anterior and posterior sternocoxal articulations 25 to 42μ; coxa IV rectangulate, basal third not or only slightly constricted, basal fifth only rarely slightly bulbose, ratio of length to width approximately 1:1.6 to 1:2.3; trochanter IV always distinctly shorter than coxa IV; tarsus IV greatly elongate and thin, usually at least twice length of tarsus III; ratio of femurogenu IV to tarsus IV, 1:5.5 to 1:10.5.

HABITS. Nothing is known of the habits of the species included in this genus. One may infer that extreme physogastry does not occur in the females. Seven of the ten forms seen by this author were taken from the bodies of various ants, the other three being found in the soil, in moss, or in woodland litter.

Species thought to belong in *Petalomium:*

?*formicarum* (Berlese, 1904) (*Pygmephorus*)

SPECIMENS EXAMINED. In addition to the types species as follows: nine species from the south-central United States and Panamá, from the following situations or hosts: *Eciton vagans* (Olivier), *E. mexicanum* Roger, *E. dulicius* Forel, (all Formicidae, Dorylinae), *Camponotus* sp. (Formicidae, Formicinae), "ants, not Dorylinae," "under rock, with ants," frass at base of stump.

Parapygmephorus (*Petalomium*) *krczali*,[30] new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 296μ (288-362, $\bar{X} = 314$); width, 210μ (210-228, $\bar{X} = 221$); width between anterior sternocoxal condyles III, —[31] (162-165); body weakly sclerotized, punctae present but indistinct (to distinct), other integumental markings lacking.

Gnathosoma. Length, —[32] (31-32); width, —[32] (33-34); dorsals stout, sparsely plumose, externals only slightly shorter than internals, arising barely posterior to and well laterad of them; anterior and posterior palpal setae about three μ apart; palpal solenidium II large, capitate, palpal solenidium I tiny, ovoid.

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[30] This species is named for Dr. Herbert Krczal, Institut für Obstkrankheiten, Heidelberg, Germany, in recognition of his outstanding contributions to the knowledge of this group.

[31] This measurement not possible on holotype.

[32] This measurement not possible on holotype.

Propodosoma. Dorsum. Broadly inversely T-shaped; distance between internal pseudostigmatal sockets 97μ (97-130, $\bar{X} = 113$); anterior pseudostigmatals sparsely plumose, about 22μ long, arising mesad of pseudostigmatal socket. *Venter.* All setae elongate, stout, distinctly plumose, 54 to 90μ long; internal ventral I much longer than external; lateral and ventral margins of circumgnathosomal foramen not greatly thickened, not forming distinct gnathosomal collar; apodemes II incomplete medially.

Hysterosoma. Dorsum. All dorsal setae sparsely plumose, stout, elongate; dorsals I anterior to line drawn between laterals I by about two areolar diameters, 103μ (85-105, $\bar{X} = 99$) long, 96μ (96-113, $\bar{X} = 106$) apart; laterals I 119μ (108-123, $\bar{X} = 118$) long, much closer to respective dorsal than dorsals to each other; dorsals II 124μ (124-144, $\bar{X} = 138$) apart, 123μ (123-134, $\bar{X} = 128$) long; dorsals III extremely elongate, 161μ (157-189, $\bar{X} = 169$) long, only 59μ (59-66, $\bar{X} = 64$) apart, laterals III 81μ (81-90, $\bar{X} = 86$) long, arising slightly anterior to and well laterad of dorsals; dorsals IV 138μ (138-175, $\bar{X} = 145$) long, about 40 to 50μ apart; laterals IV 59μ (59-74, $\bar{X} = 63$) long, distinctly more slender than dorsals and arising slightly anterior to and well laterad of them; setae of segment V aciculate, sparsely plumose, arising from the ventral margin of the opisthosoma; internal caudal as stout (or stouter) at the base than dorsals III and IV, 64μ (58-70, $\bar{X} = 65$) long, external caudals I and II subequal in size, 19 to 28μ long, distinctly less than half as wide at base as internal caudals, external caudals I arising much closer to internal caudals than to external caudals II; posterior genital sclerite indistinct, median genital sclerite single, rounded (to irregular) in shape. *Venter.* All setae of posterior ventral plate elongate, stout, sparsely plumose, about 55 to 85μ long; line drawn between first axillaries dividing distance between internal and external presternals approximately in half; external presternals laterad of internal presternals, much closer to them than to first axillaries; line drawn between second axillary and internal presternal passing barely anterior to areolus of external presternal; external poststernals arising behind line drawn between posteromesal margins of coxal foramina IV by about a third the length of the coxal base; apodemes III indistinct (to weakly distinct as far as internal presternals); apodemes IV weak but distinct, bending posteriorly at the sides to join mesal margins of coxal foramina III behind their centers.

Legs (all measurements in μ). *Length.* Leg I, 77 (77-81, $\bar{X} = 78$); leg II, 123 (123-147, $\bar{X} = 134$); leg III, 141 (141-162, $\bar{X} = 149$); leg IV, 233 (233-289, $\bar{X} = 261$). *Width.* Leg I, 18 (18-20, $\bar{X} = 19$); leg II, 25 (25-31, $\bar{X} = 28$); leg III, 23 (23-25, $\bar{X} = 24$); leg IV, 18 (18-25, $\bar{X} = 23$). *Segment lengths.* Tr I, —[33] (17-23, $\bar{X} = 20$); tita I, 46 (44-46, $\bar{X} = 45$); tr II, —[33] (36-45, $\bar{X} = 42$); ta II, —[33] (48-58, $\bar{X} = 54$); tr III, —[33] (42-55, $\bar{X} = 48$); ti III, 24 (24-28, $\bar{X} = 26$); ta III, 61 (52-61, $\bar{X} = 57$); cx IV, 59 (59-74, $\bar{X} = 65$); tr IV, 34 (34-44, $\bar{X} = 40$); fege IV, 14 ($\bar{X} = 14$); ta IV, 102 (102-128, $\bar{X} = 115$). *Setation.* Leg I: cx 1T, tr 2T + 1 modified; fege 4T, tita 11T + 9S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 2S, ta 6T; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV: cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Tip of seta *c* of trochanter I not proflexed, seta *d* similar in shape but longer and more slender; solenidium 3 of tibiotarsus I about 14μ, thickly rodlike, attenuate, apex sharply acuminate; solenidium 4 nearly as long as 3, similar in shape but thinner, apex less acuminate; length of pinnaculum distinctly more than twice its width; tibiotarsus I distinctly wider than femurogenu I, elliptical; tibial solenidia of legs II and III basal, clavate, short; solenidium of tarsus II about 11μ, bullet-shaped, apex sharply acuminate; coxa IV rectangulate, ratio of length to width, 1:1.8 to 1:2.1; lateral setae of trochanter IV and tibia IV greatly elongate, the former reaching nearly to, the latter well beyond claw IV; tarsus IV greatly elongate, 102μ (102-128, $\bar{X} = 115$) long, evenly attenuate, the pretarsus also elongate and slender, about 22μ; claws IV greatly reduced, nearly vestigial; ratio of femurogenu IV to tarsus IV, 1:7.3 to 1:9.2.

HABITS. Nothing is known of the habits of this species.

DISTRIBUTION. Known only from the type locality.

TYPE MATERIAL. Female holotype and four female paratypes from Volo, Lake County, Illinois, October 14, 1956, B. Greenberg, from sphagnum moss in tamarack bog (berlese).

TYPE REPOSITORIES. Holotype and one paratype (no. 1) in the Chicago Natural History Museum, Chicago, Illinois, one paratype (no. 2) in the Snow Entomological Museum at The University of Kansas, one paratype (no. 3) in the U. S. National Museum, Washington, D. C., and one paratype in the Zoologisches Institut, Universität Erlangen, Erlangen, Germany.

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[33] This measurement not possible from holotype.

Acinogaster, new genus

(Figs. 90-92)

Type, *Acinogaster marianae*, new species.

This new genus includes six previously undescribed forms associated with doryline ants in both the Old and New Worlds. Its members are very closely related to and considered by this author to form an "exgroup" of the genus *Parapygmephorus*. They are easily separable from all members of that genus by several interesting specializations as noted below.

Only the non-gravid females are known.

DIAGNOSIS. Females are separable from those of all other genera in the tribe in that at least internal ventrals I and II and axillaries I and II are modified, being enlarged, flattened, and of varying shapes but not setiform.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 170 to 300μ; width, 90 to 175μ; distance between anterior sternocoxal condyles of coxae III, 70 to 120μ; hysterosoma elliptical to ovate; integument of body weakly to moderately sclerotized, lacking engravings; striae absent on most lateral portions of posterior ventral plate; body with or without distinct, coarse punctures.

Gnathosoma. As wide as to slightly wider than long; palpal solenidium 2 large, globular or capitate; esophagus straight, thick, sometimes with short thickened area, "bow-tie" structures lacking.

Propodosoma. Integument weakly sclerotized, similar to that of hysterosoma or with heavily sclerotized areas which are variable in shape and extent. *Dorsum.* Inversely T-shaped, usually thickly so; distance between internal pseudostigmatal sockets distinctly greater than length of propodosoma; lateral margins of circumgnathosomal foramen not greatly thickened to form foraminal collar; posterior margin to posterior third covered by first hysterosomal tergum; pseudostigmata located between posterior half and posterior quarter; peritremes circular, large, weakly rimmed or rim lacking, their mesal margins emarginate or not; peritremes widely separated, located in anterior third of dorsum or in propodosomal shoulders; esophageal "finned" structures indistinct. *Venter.* At least three pairs of setae of anterior ventral plate modified bladelike, paddlelike, or clublike; internal ventrals I anterior to, in line with, or posterior to external ventrals I; internal ventrals II usually in transverse line with, rarely well anterior to external ventrals II, often as close to anterior median apodeme as to latter setae; external ventrals

I not furcate; coxa I articulated obliquely to longitudinal axis of body; apodemes II variable but always weak, appearing as integumental creases or hidden within strongly sclerotized venter, arcuate or sharply U-shaped, complete or not; secondary suture variously developed, also usually appearing creaselike; anterior median apodeme complete, variable in distinctness; posterior marginal apodemes usually straight, often greatly thickened at lateral angles, thickening rarely extending bandlike mesally across venter; pleated conjunctival band distinct between propodosoma and hysterosoma or not.

Hysterosoma. Dorsum. First segment overlapping posterior margin to posterior fourth of propodosoma; fifth segment bearing three pairs of apicoventral setae; vulva apical, distinct, apical portion of vaginal wall usually sclerotized but never thickly so; posterior genital sclerite usually elongate and evenly attenuate posteriorly, flaplike but often indistinctly so, or occasionally broadly triangular and flaplike; median genital sclerite present. *Venter.* Posterior ventral plate with six pairs of setae, its hind margin undulate or broadly emarginate; first axillaries never anterior to anteriormost margin of coxal foramina III by more than twice their areolar diameters; posterior ventral plate distinctly produced over anterior portion of coxae III; external presternals always arising well anterior to apodemes IV, the distance between them much greater than that between internal presternals; external poststernals always arising less than half (usually less than a quarter) the basal width of coxa IV behind mesal, posterior sclerotization of fourth coxal foramen; apodemes III indistinct to distinct, if distinct reaching laterally as far as middle of coxal foramina III but not bending posteriorly to join it; apodemes IV distinct or not, if so then bending posteriorly to join coxal foramina III at or behind middle, joining posterior median apodeme on or between lines drawn between anterior third and posterior third of coxal foramina III; posterior median apodeme distinct or not, variable, if distinct, portion behind apodemes IV usually smaller than that anterior to apodemes IV; well defined band of opisthosomal pleats absent behind coxae IV and dorsally between segments III and IV; opisthosoma distinctly longer than distance between anterior margin of coxa III and posterior margin of coxa IV; opisthosomal venter lacking integumental engravings.

Legs. Moderately elongate, stout, ratio of length to width of trochanter IV, 1:1.4 to 1:2.2; legs I subequal, to slightly or distinctly shorter than legs II, always much longer than gnathosoma; tibiotarsus I two to two and one-half times as long as wide, as wide as or only slightly wider than femurogenu I; pinnacula reduced to moderately developed, height sometimes one and one-half times apical width; mediolateral sclerotized area of tibiotarsus I usually well developed, becoming enlarged and circular or nearly so dorsally; claw I dilate basally or not, pedicellate, pedicel usually longer than wide, constricted basally, thumb weakly developed; trochanter I with three setae, the apical portion of seta *c* weakly or strongly proflexed; tarsi II and III each with six tactiles; basal solenidium of tarsus II displaced basad, arising from apical margin of tibia II; basal solenidia of tibiae II and III present; pretarsi II to IV short, never more than one-third the length of the tarsi; claws II and III with large basal dilations, claw IV simple, smaller or rarely absent; pulvilli II and III always distinctly longer than claws, pulvillus IV variable in length; coxa III elongate-subcordate, distance between anterior and posterior sternocoxal articulations, 20 to 30μ; coxa IV rectangulate to short-rectangulate, basal third not or only slightly constricted, basal fifth not or only slightly bulbose, ratio of length to width approximately 1:1.6 to 1:2.0; trochanter IV usually distinctly shorter than, rarely subequal to coxa IV; femurogenu IV usually wider than long, bearing one seta; tarsus IV slender and elongate, evenly attenuate, always at least twice as long as tarsus III; ratio of femurogenu IV to tarsus IV, 1:4.5 to 1:6.8.

HABITS. Little is known of members of the group. The non-gravid females are common as phoretics upon many species of army ants, usually between coxae I. According to C. Rettenmeyer (*in litt.*) the number present per ant is small.

To date, six species, all undescribed, are known, these found upon fourteen species of Dorylinae. Table VII summarizes our knowledge of the host relationships of the various American species of the genus.

Although sample sizes are variable, this table presents some useful information as regards host relationships. Only one of the six species of *Acinogaster* is restricted to a single species of ant (sp. V, to *Neivamyrmex legionis*), while each of four species of ants is seen to carry but one mite species as follows: *Eciton hamatum* with only *marianae*, *E. vagans* with only species XX, and *Neivamyrmex opacithorax* and *nigrescens* with only species XXX.

Species XX is apparently most catholic in its host preference, being known from 11 different species of ants.

Members of the genus offer opportunity to study interrelationships between geographical and host variation.

TABLE VII.—Distribution of *Acinogaster* sp. Upon Various American Doryline Ants

Mite species	Ant species	Number mites/ant species	Percent mite species/ ant species	Percent, total no. all mites/ant species[a]
A. marianae	*Eciton hamatum* (Fabricus)	53	17	100
	E. burchelli (Westwood)	255	83	95
			100	
A. sp. III	*Eciton dulcius* Forel	4	4	44
	Nomamyrmex hartigi (Westwood)	1	1	25
	N. esenbecki (F. Smith)	2	2	33
	Labidus praedator (F. Smith)	84	81	60
	L. coecus (Latreille)	5	5	71
	Neivamyrmex pilosus (F. Smith)	5	5	71
	N. gibbatus Borgmeier	1	1	33
	N. legionis (F. Smith)	1	1	14
			100	
A. sp. XX	*Eciton vagans* (Olivier)	3	3	100
	E. dulcius	5	5	56
	E. mexicanum Roger	11	11	100
	E. burchelli	14	13	5
	Nomamyrmex hartigi	3	3	75
	N. esenbecki	4	4	66
	Labidus coecus	2	2	
	L. praedator	57	54	40
	Neivamyrmex pilosus	2	2	29
	N. gibbatus	2	2	66
	N. legionis	2	2	29
			100	
A. sp. XXX[b]	*Neivamyrmex nigrescens* (Cresson)	13	46	100
	N. opacithorax (Emery)	15	54	100
			100	
A. sp. V	*Neivamyrmex legionis*	4	100	57

a. Obtained by totalling number of mites for each ant species, apportioning each mite species therefrom.

b. May be only geographic variant of XX.

DISTRIBUTION. Various species are known from Brazil, British Guiana, Trinidad, Panamá, Kansas (U. S. A.), and Angola.

SPECIMENS EXAMINED. In addition to the type species, as follows: *Species II.* ANGOLA: Nova Lisboa Prov., 19 ♀ ♀ from *Dorylus* (*Anomma*) sp. *Species III.* PANAMÁ (C. Z.): Barro Colorado Is., 84 ♀ ♀ from *Labidus praedator.* Same, 5 ♀ ♀ from *L. coecus.*

Same, 4 ♀ ♀ from *Eciton dulcius.* Same, 2 ♀ ♀ from *Nomamyrmex esenbecki.* Same, 1 ♀ from *Neivamyrmex gibbatus.* Same, 5 ♀ ♀ from *N. pilosus.* Cerro Galera (K-6 Road), 1 ♀ from *Nomamyrmex hartigi.* BRAZIL: Nova Teutonia, 27° 11′S., 52°28′W., 1 ♀ from *Neivamyrmex legionis. Species XX.* PANAMA (C.Z.): Barro Colorado Is., 3 ♀ ♀ from *Eciton vagans.* Same, 5 ♀ ♀ from *E. dulcius. Same,* 11 ♀ ♀ from *E. mexicanum.* Same, 4 ♀ ♀ from *Nomamyrmex esenbecki.* Same, 2 ♀ ♀ from *Labidus coecus.* Same, 57 ♀ ♀ from *L. praedator.* Same, 2 ♀ ♀ from *Neivamyrmex pilosus.* Same, 2 ♀ ♀ from *N. gibbatus.* Cerro Galera (K-6 Road), 3 ♀ ♀ from *Nomamyrmex hartigi.* BRAZIL: Nova Teutonia, 2 ♀ ♀ from *Neivamyrmex legionis.* BRITISH GUIANA: Oronoque River at New River, 10 ♀ ♀ from *Eciton burchelli cupiens. Species XXX.* KANSAS: Lawrence, 15 ♀ ♀ from *Neivamyrmex opacithorax.* Univ. Kansas Nat. Hist. Res., 12 ♀ ♀ from *N. nigrescens.* Topeka, 1 ♀ from *N. nigrescens. Species V.* BRAZIL: Nova Teutonia, 27°11′ S., 52°23′ W., 4 ♀ ♀ from *Neivamyrmex legionis.*

Acinogaster marianae,[34] new species

DESCRIPTION OF NON-GRAVID FEMALE. Length, 333μ (267-346, $\bar{X} = 311.40 \pm$ S. E. 8.14); width, 183μ (157-210, $\bar{X} = 181.70 \pm$ S. E. 5.91); width between anterior sternocoxal condyles III, 126μ (101-126, $\bar{X} = 115.44$); body moderately sclerotized.

Gnathosoma. Length, 26μ (24-30, $\bar{X} = 26.50$); width, 25μ (25-31, $\bar{X} = 28.50 \pm$ S. E. 0.65); dorsals stout, internals slightly longer than externals, arising well mesad and slightly in front of them; distance between externals greater than that between external and respective lateral; palpal tooth large, distinct; solenidium II large, globular or capitate, solenidium I strobiloid, arising nearly laterad of II.

Propodosoma. Dorsum. Broadly inversely T-shaped (shape varying somewhat according to mount), distance between internal pseudostigmatal sockets, 91μ (72-91, $\bar{X} = 84.33$); sclerotization distinctive, uneven, heaviest in circular area immediately mesad of each pseudostigma, this area forming a broad tubercle; posterior margin of dorsum excavated, thickly sclerotized, sclerotized areas becoming broader at the sides; anterior pseudostigmatal setae short, nude, bristlelike, posterior pseudostigmatals stout, sparsely plumose, arising well laterad of and only slightly posterior to internal pseudostigmatal socket. *Venter.* External and internal ventrals I and internal ventrals II modified, greatly thickened and flattened; internal sternals I and II clavate, similar in shape, but I distinctly larger than II; external ventral I broader than internal but elongate-cylindrical, its apex acuminate; external ventral II stoutly setiform, plumose; internal ventral I slightly behind line drawn between external ventrals I (but relationships depend greatly upon mount); internal ventrals II approximately in transverse line with external ventrals II; posterior marginal apodemes well developed, becoming greatly enlarged at the sides; anterior median apodeme prolonged taillike behind union with posterior marginal apodemes; band of pleated conjunctiva distinct (or indistinct) dorsally between propodosoma and hysterosoma.

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[34] This species is named in honor of Mrs. Marian E. Rettenmeyer who, with her husband Carl, collected the type series.

Hysterosoma. Dorsum. All dorsal setae stout, setiform, elongate, moderately plumose; dorsals I 56μ (51-64, $\bar{X} = 60.89$) long, 63μ (53-69, $\bar{X} = 61.90$ ± S. E. 1.84) apart, distinctly closer to respective laterals than to each other; laterals I arising only slightly behind line drawn between dorsals, 99μ (78-108, $\bar{X} = 92.78$) long; dorsals II 56μ (46-56, $\bar{X} = 52.70$ ± S. E. 1.25) long, 81μ (59-85, $\bar{X} = 76.50$ ± S. E. 2.71) apart; dorsals III 68μ (59-76, $\bar{X} = 67.22$) long, 74μ (59-84, $\bar{X} = 72.80$ ± S. E. 2.44) apart; laterals III well laterad of and slightly behind dorsals III, 44μ (31-50, $\bar{X} = 43.44$) long; dorsals IV 88μ (70-92, $\bar{X} = 83.20$ ± S. E. 2.35) long, 62μ (45-76, $\bar{X} = 61.30$ ± S. E. 3.30) apart; laterals IV posterolateral to dorsals IV, 50μ (40-51, $\bar{X} = 46.30$ ± S. E. 1.34) long; internal caudals much longer and stouter than other setae of segment V, 44μ (36-45, $\bar{X} = 40.90$ ± S. E. 0.96) long; areoli of external caudals I nearly contiguous with those of internal caudals, 17μ (15-18, $\bar{X} = 16.57$) long; external caudals II slightly longer than external caudals I and of the same conformation, 20μ (17-23, $\bar{X} = 19.00$ ± S. E. 0.64), about three to four times as far from external caudals I as the latter are from internal caudals; median genital sclerite distinct, globular (to irregular) in shape. *Venter.* First and second axillary setae modified, remaining setae of posterior ventral plate setiform, moderately and subequally sized, nude or nearly so, flagellate; first axillary bladelike, straight, with distinct prickle, second axillary similar but moderately proflexed near tip; external presternals well in front of apodemes IV, only slightly behind first axillaries, in lateral one quarter of posterior ventral plate; internal poststernals slightly laterad of internal presternals, approximately on transverse line drawn across posterior termination of posterior median apodeme;

poststernals not reaching halfway to posteriormost margin of opisthosoma; mesal portion of hind margin of posterior ventral plate broadly and shallowly lobate, lateral margins indistinct.

Legs (all measurements in μ). *Length.* Leg I, 97 (84-100, $\bar{X} = 94.80 \pm$ S. E. 1.67); leg II, 121 (100-126, $\bar{X} = 117.10 \pm$ S. E. 2.75); leg III, 128 (109-140, $\bar{X} = 126.67$); leg IV, 208 (173-214, $\bar{X} = 200.70 \pm$ S. E. 4.38). *Width.* Leg I, 14 (14-20, $\bar{X} = 17.60 \pm 0.65$); leg II, 25 (23-30, $\bar{X} = 26.90 \pm$ S. E. 0.82); leg III, 22 (20-25, $\bar{X} = 23.10 \pm$ S. E. 0.53); leg IV, 18 (15-19, $\bar{X} = 17.30 \pm$ S. E. 0.42). *Segment lengths.* Tr I, 26 (25-30, $\bar{X} = 26.33$); tita I, 54 (46-54, $\bar{X} = 51.50 \pm$ S. E. 0.85); tr II, 41 (30-41, $\bar{X} = 37.00 \pm$ S. E. 1.21); ta II, 44 (39-48, $\bar{X} = 44.20 \pm$ S. E. 1.03); tr III, 47 (37-51, $\bar{X} = 45.89$); ti III, 23 (20-23, $\bar{X} = 21.80 \pm 0.33$); ta III, 47 (40-52, $\bar{X} = 45.40 \pm 1.16$); cx IV, 56 (44-57, $\bar{X} = 53.70 \pm$ S. E. 1.46); tr IV, 34 (31-37, $\bar{X} = 34.50 \pm$ S. E. 0.69); fege IV, 13 (11-13, $\bar{X} = 12.30 \pm$ S. E. 0.21); ta IV, 81 (66-85, $\bar{X} = 78.10 \pm$ S. E. 1.98); *width of coxa IV,* 26 (23-30, $\bar{X} = 27.00$). *Setation.* Leg I: cx 1T, tr 3T, fege 4T, tita 11T + 8S; leg II: cx 1T, tr 3T, fege 3T, ti 4T + 2S, ta 6T; leg III: cx 1T, tr 2T, fege 2T, ti 4T + 1S, ta 6T; leg IV; cx 1T, tr 2T, fege 1T, ti 4T + 1S, ta 6T.

Apex of seta *c* of trochanter I distinctly proflexed, seta *d* sinuate, resembling sense seta; mediolateral sclerotized plate of tita I prominent between solenidia 2 and 3, marginal, rounded; solenidium 3 of tibiotarsus I short, strobiloid, distad of above spot, solenidia 1 and 2 arising together beneath it, one clavate-pedicellate, the other bullet-shaped; claw I moderately sized, arising from funnel-shaped pedicel; solenidium of tibia II basal, strobiloid, solenidium of tarsus II displaced basad, arising from apical margin of tibia II, bullet-shaped, with apical prickle; solenidium of tibia III distinctly smaller than that of tibia II, clavate; coxa IV rectangulate, ratio of length to width, 1:1.5 (1:1.4 to 1:1.6); external apical seta of tibia IV longest seta of leg; tarsus IV very elongate, slender, tapering basally; ratio of femurogenu IV to tarsus IV, 1:3.4 (1:3.4 to 1:4.7).

HABITS. See description of genus.

DISTRIBUTION. Known only from Panamá and from Trinidad, British West Indies.

TYPE MATERIAL. Female holotype from Barro Colorado Island, Panamá (Canal Zone), June 16, 1956, C. W. and M. E. Rettenmeyer, from *Eciton hamatum*, colony E-189 (Slide No. 1804). Two paratypes (nos. 3 and 4) same data except taken August 17, 1956, from *E. burchelli,* colony No. E-253. Two paratypes (nos. 6 and 8) same data as preceding except taken on May 12, 1956, from colony No. E-148. Paratype No. 8 same data except taken April 20, 1956, from colony No. E-149. Two paratypes (nos. 1 and 5) same data except taken March 1, 1955, C. W. Rettenmeyer from colony 55-B-II. Two paratypes (nos. 2 and 7) from 7 mi. N. W. of Balboa, Cocolí, Panamá (C. Z.), January 1, 1957, W. Lundy, from *E. burchelli.*

TYPE REPOSITORIES. Holotype and four paratypes (nos. 3, 4, 8, 9) in the Snow Entomological Museum at The University of Kansas. One paratype (no. 2) in the Zoologische Institut, Universität Erlangen, Erlangen, Germany. One paratype (no. 1) in the U. S. National Museum, Washington, D. C. One paratype in the British Museum (Natural History), London. One paratype (no. 6) in the private collection of C. W. Rettenmeyer, Kansas State University. One paratype (no. 5) in the private collection of the author.

SPECIMENS EXAMINED. Other than the type series, as follows: PANAMÁ (C. Z.): Barro Colorado Island, various dates between Feb. 9, 1955, and Aug. 17, 1956, C. W. and M. E. Rettenmeyer or C. W. Rettenmeyer, 247 ♀ ♀ on *Eciton burchelli.* Same locality and collectors, various dates between March 21 and July 9, 1956, 53 ♀ ♀ from *E. hamatum.* Seven mi. N. W. of Balboa, Cocolí, Jan. 1, 1957, W. Lundy, 6 ♀ ♀ from *E. burchelli.* TRINIDAD: Arima Valley, Spring Hill Estate, April 6, 1935, N. A. Weber, 1 ♀ from *E. burchelli.* South margin, Nariva Swamp, March 10, 1935, N. A. Weber, 1 ♀ from *E. b. urichi* Forel. Northern Range, just north of St. Augustine, June 2, 1935, N. Weber, 1 ♀ from *E. b. urichi.* BRITISH GUIANA: Oronoque River at New River, July 21, 1936, N. A. Weber, 3 ♀ ♀ from *E. b. cupiens* Santschi.

Pseudopygmephorus, new genus

(Figs. 93-94)

Type, *Pygmephorus tarsalis* Hirst, 1921.

This genus is erected to contain a number of forms closely related to and perhaps directly ancestral to the genera *Microdispus* and *Neopygmephorus.* Primitive forms of the genus, *e. g. P. sellnicki* (Krczal, 1958) superficially resemble members of *Siteroptes* (*Siteroptoides*), but closer examination indicates that they are probably not direct descendents of the latter, but are more closely related to *Pygmephorus* and certain *Parapygmephorus,* and the development of such characteristics as elongate legs I and sicklelike claws on legs I to III may be regarded as secondary. Members of the genus show increasing specialization, forms considered by the author to be the most advanced closely resembling less specialized forms of the genus *Neopygmephorus.* Because the members of the two groups may be satisfactorily separated, and because of the size of the genus *Neopygmephorus,* the author prefers to consider *Pseudopygmephorus* a distinct genus containing at least fifteen described forms.

DIAGNOSIS. In addition to the key characters given above, females may be distinguished from those of other neopygmephorines by the following combination of characters: external presternals arising from or barely in front of apodemes IV or, if not, then apodemes III distinct laterally and bending posteriorly to meet anterior sternocoxal condyles III; claw I rarely lacking, otherwise moderate to small in size, without thumb, always arising from a distinct, stalklike pedicel.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 160 to 300μ; width 85 to 160μ; width between anterior sternocoxal condyles of coxae III, 50 to 100μ; hysterosoma rather narrowly to broadly elliptical in dorsoventral aspect, posterior margin evenly rounded to truncate; body weakly to moderately sclerotized, without scalelike or "pebbled" integumental markings, not striate on most lateral portions of posterior ventral plate but usually distinctly punctate.

Gnathosoma. Always distinctly longer than wide; palps semipalmate, possessing one or more apical teeth, comprising about half length of gnathosoma; chelicerae small, usually indistinct; small circumesophageal pump sometimes present, a second, "bow-tie-shaped" circumesophageal structure often present behind pump.

Propodosoma. Dorsum. Elongate, inversely T-shaped or trapezoidal, length usually much greater than, rarely subequal to distance between internal pseudostigmatal sockets; anterior portion prolonged hoodlike anteriorly and ventrally over gnathosoma, circumgnathosomal foramen ventral; posterior margin narrowly covered by first hysterosomal segment; pseudostigmata located in posterior one third; two distinct pairs of propodosomal setae; peritremes dorsal or dorsolateral, elongate and throughlike, longguttate, or guttate, if as first two then diverging anteriorly, if as the latter then stigmatal openings in median or posteromedian excavation; esophageal "finned" structure distinct or not, if distinct, then posterior globose structure always more prominent than elongate anterior one, fins indistinct in both. *Venter.* Internal ventrals I distinctly anterior to externals, internal ventrals II slightly to well anterior to external ventrals II, usually much closer to them than to anterior median apodeme, both pairs rarely approximate to coxal foramina II; external ventrals I commonly bifurcate; coxa I articulated at nearly a right angle to longitudinal axis of body or distinctly obliquely; apodemes II arcuate, together sometimes lyrate, or weakly W-shaped, always complete; secondary transverse apodeme usually absent, rarely present laterally; anterior median apodeme strong and complete; posterior marginal apodemes strong, straight to gently arcuate; distinctly pleated conjunctival band absent between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First segment covering only posterior quarter to posterior third of propodosoma; fifth segment bearing two (rarely) or three pairs of ventral to apicoventral setae; vulva apical and distinct, often located within genital sulcus; vaginal walls usually distinct apically, globose or elliptical pumplike enlargements usually lacking (present in *sellnicki* group); posterior genital sclerite irregularly rounded, triangular, or rarely, triangular and flaplike. *Venter.* Posterior ventral plate with five or six pairs of setae, if five then second axillaries missing; hind margin of posterior ventral plate variable, entire and linear or lobate or (rarely, *sellnicki* group) tripartite, incisions reaching nearly to posterior foraminal margin of coxa IV; external presternals always arising from or barely before apodemes IV, or if well anterior to apodemes IV, then directly behind internal presternals; transverse distance between external presternal and internal presternal as great as or greater than longitudinal distance between external presternal and first axillary; external poststernal behind posterior foraminal thickening by less, usually much less, than basal width of coxa IV; apodemes III variable in definition and extent; apodemes IV directed toward anterior third or quarter of, reaching coxal foramina III or not, if so, then bending sharply posteriorly to join foramina behind their centers (*sellnicki* group); if apodemes IV reach foraminal margin, then apodemes III are well defined and bend sharply posteriorly to meet anterior sternocoxal condyles; posterior median apodeme well defined, portion behind apodemes IV not more than one and one-half times that anterior to apodemes IV; bands of opisthosomal conjunctival pleats absent; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV; opisthosomal venter lacking integumental engravings.

Legs. Leg I usually longer than or subequal to, always wider than leg II; tibiotarsus I elongate, at least twice as long as wide, only rarely distinctly wider than femurogenu I; pinnacula lacking; mediolateral sensory area present or not, if present marginal and irregular in shape; claw I simple or basally dilated, small to moderate in size, distinctly pedicellate, pedicel always much longer than wide, stalklike, thumb lacking or greatly reduced; trochanter I with three setae, seta *c* with apical portion proflexed; tarsi II and III each with six tactiles; solenidia of tibiae II and III present; pretarsi II to IV short, one-quarter the length of the tarsi or less; claws II to III simple or dilated basally, claws IV simple, subequal to or smaller than those of II and III; coxa III subcordate or triangular as viewed in ventral aspect; coxa IV short-rectangulate to rectangulate, basal third with or without distinct constriction, basal fifth distinctly bulbose or not, ratio of length to width, 1:1.3 to 1:2.2; trochanter IV at least slightly shorter than coxa IV; tarsus IV short to moderately long, usually abruptly narrowed, always distinctly longer than tarsus III; ratio of femurogenu IV to tarsus IV, 1:2.8 to 1:3.7.

Species thought to belong to *Pseudopygmephorus:*

abdominalis (Berlese, 1904) (*Pygmephorus*)
abdominalis polonicus (Willmann, 1949) (*Pygmephorus*)
abdominalis var. *sudetica* (Willmann, 1956) (*Pygmephorus*)
arcticus (Sig Thor, 1934) (*Pediculoides*)
arvorum (Krczal, 1959) (*Pygmephorus*)
decumanus (Krczal, 1959) (*Pygmephorus*)
disparisetae (Jacot, 1936) (*Pygmephorus*)
haarloevi (Krczal, 1958) (*Pygmephorus*)
inconspicuus (Berlese, 1904) (*Pygmephorus*)
kochi (Krczal, 1959) (*Pygmephorus*)
?*quadratus* (Ewing, 1917) (*Pygmephorus*) = (*sellnicki* Krczal?)
sellnicki (Krczal, 1958) (*Pygmephorus*)
suecicus (Krczal, 1959) (*Pygmephorus*)
tarsalis (Hirst, 1921) (*Pygmephorus*)
togatus (Willmann, 1942) (*Pygmephorus*)
willmanni (Krczal, 1959) (*Pygmephorus*)

HABITS. Unknown. None have been found to be phoretic upon insects, although two species, *haarloevi* and *willmanni* are known only from the nests of the ant, *Lasius flavus* Mayr. Species known only from decaying plant materials are *kochi, decumanus,* and *abdominalis* var. *sudetica.* Other forms have been taken from soil and from small mammals.

While some forms such as *haarloevi* and *willmanni* may be restricted in their host associations, the ecological distribution of some species is amazingly broad. *P. sellnicki,* for example, is recorded by Krczal, (1959b), from various small rodents and insectivores, from soil, and from lily bulbs. The present author finds a form considered to be the same species in various other habitats (see "Specimens examined").

Mites associated with rodents are often found in the nests or in food caches, and, as Vitzthum (1943), has stated, probably stand only in a phoretic relationship to them.

SPECIMENS EXAMINED. Five species, including *sellnicki* and probably *tarsalis,* from most of the United States and from England and Japan, from the following situations or hosts: commercial mushroom houses, peach orchard soil, grass, grain, leaf mold, moss, decayed tomatoes, pea ensilage, frostscar, oat straw, lily bulbs, African marigolds, manure, decaying log, treehole of *Fagus grandifolia,* unoccupied nest of *Microtus* sp., from *Peromyscus maniculatus gracilis* (LeConte), burrow of *Cynomys* sp. and debris pile of *Neotoma* sp. (all Cricetidae), from *Pipistrellus subflavus* (F. Cuvier) (Chiroptera).

Neopygmephorus, new genus

Type, *Pygmephorus blumentritti* Krczal, 1959.

The author erects this genus to include a large number of forms placed by previous authors in the genus *Pygmephorus.* As presently conceived, the genus remains one of the largest in the family, containing at least thirty species, these divided into the two subgenera *Allopygmephorus* and *Neopygmephorus sensu stricto.* The former contains but two forms which differ greatly from *Neopygmephorus s. str.,* and secondarily resemble some Microdispini in having lost one pair of propodosomal and one pair of caudal setae and because the most lateral margins of the posterior ventral plate possess distinct pleats. Because intergradation between these more specialized forms and typical species of *Neopygmephorus* seems to occur, they are considered as subgenera herein.

Species of *Neopygmephorus* are most closely related to those of *Parapygmephorus* and *Pseudopygmephorus.*

Except for the male of one species, to be described elsewhere, only the non-gravid females are known. Species are known from Europe, Asia, North and South America, Australia, and Antarctica.

DIAGNOSIS. Females of *Neopygmephorus* are separable from those of all other genera in the tribe by the following combination of characters: leg I usually more slender than, rarely as wide as leg II; coxa IV usually broadly constricted near basal third, coxal base appearing bulbose or bilobate, or, if not, then legs long and slender, ratio of length to width of trochanter III 1:2.3 to 1:4.2.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 145 to 390μ; width, 70 to 230μ; distance between anterior sternocoxal condyles III, 70 to 155μ; hysterosoma rather narrowly to broadly ellipitical or oval; body moderately to heavily sclerotized, only rarely with integumental engravings, these restricted to the lateral or posterolateral portions of the posterior ventral plate if present; striae rarely present on most lateral portions of above plate; body usually distinctly punctate.

Gnathosoma. Well developed, usually only slightly longer than wide, never wider than long; chelicerae tiny, if distinct, needlelike.

Propodosoma. Dorsum. Inversely T-shaped to broadly trapezoidal, shape greatly dependent upon mount; lateral margins of circumgnathosomal foramen not thickened or enlarged to form collar; dorsum narrowly to nearly completely covered by first hysterosomal segment; pseudostigmata usually located in posterior third; one (rarely) or two pairs of propodosomal setae; peritremes usually rimmed, circular or transversely ovoid, their mesal margins nearly always broken or emarginate; peritremes usually smaller than, rarely subequal to diameter of external pseudostigmatal socket; peritremes located in mesal or posterior (rarely) third of propodosoma; esophageal "finned" structures distinct or not, if distinct then usually three in number. *Venter.* Internal ventrals I usually posterior to or in a transverse line with external ventrals I, rarely anterior to them; internal ventrals II distinctly anterior to externals II and much closer to them than to anterior median apodeme; external ventrals I forked or not; coxa I always articulated distinctly obliquely to longitudinal axis of body; apodemes II usually appearing arcuate and complete (see morphology p. 46), terminating anteriorly at external sternal I or incomplete laterally; secondary transverse apodeme usually present and distinct as far as apodemes II (see morphology, p. 46), or more rarely distinct only laterally or absent entirely; anterior median apodeme complete or not; posterior marginal apodemes moderately developed medially, straight or gently arcuate; distance between apodemes I and II distinctly less than that between apodemes II and posterior marginal apodemes; pleated conjunctival band not visible between propodosoma and hysterosoma.

Hysterosoma. Dorsum. First tergum usually covering only posterior quarter, rarely posterior three-quarters of propodosomal dorsum; fifth segment bearing two or (usually) three pairs of setae, these apical or apicoventral; vulva apical, distinct, vagina sometimes sclerotized apically but lacking globose or elliptical pump-like organ; posterior genital sclerite usually distinct, narrowly to broadly triangular and flaplike or (rarely) formed otherwise or absent; median genital sclerite lacking. *Venter.* Posterior ventral plate with six pairs of setae, its hind margin entire, straight to broadly rounded; external presternals usually arising at least one areolar width anterior to apodemes IV, rarely less; external poststernals usually arising at least half the basal width of coxa IV behind posteromesal sclerotization of fourth coxal foramen; apodemes III distinct or not, never bending at sides to fuse with anterior sternocoxal condyles III; apodemes IV (except in *Allopygmephorus*) extending at least three-quarters of distance to coxal foramina III; apodemes IV usually directed toward or joining coxal foramina at or in front of line drawn between their centers; apodemes IV joining posterior median apodeme on or above line drawn between points demarking anterior third of foraminal margin; posterior median apodeme well defined, portion behind apodemes IV usually at least one and two-thirds times as long as that anterior to apodemes IV; thick bands of opisthosomal conjunctival pleats absent, thin bands occasionally present, especially dorsally between segments three and four; opisthosoma distinctly longer than distance between anterior margin of coxal foramen III and posterior margin of coxal foramen IV.

Legs. Legs usually elongate and thin, ratio of length to width of trochanter IV, 1:2.4 to 1:4.5, only rarely under 1:2.7; leg I usually shorter and thinner than, rarely subequal to leg II; tibiotarsus I usually elongate, usually at least twice as long as wide, distinctly wider than femurogenu I or not; pinnacula lacking or if present reduced, free portion not much higher than width at apex; mediolateral sclerotized area present or not, if present varying in shape and location; claw I usually present, dilate basally, small to moderate in size, distinctly pedicellate, pedicel usually much longer than wide, occasionally constricted basally and as wide or wider than long; thumb lacking or greatly reduced; apical portion of seta *c* of trochanter I strongly or weakly proflexed and attenuate; tarsi II and III each with six tactiles; solenidia of tibiae II and III present, solenidium of tarsus II arising from the latter's base; claws II and III basally dilate, claws IV subequal to them in size or smaller, simple; coxa III short, subcordate in inner ventral aspect, distance between anterior and posterior sternocoxal articulations, 16 to 33μ (usually 16-25); coxa IV rectangulate, basal third always slightly, usually greatly constricted, basal fifth distinctly to greatly bulbose, ratio of length to width, 1:2.0 to 1:3.1; trochanter IV variable in length, distinctly shorter to much longer than coxa IV; tarsus IV short, variously shaped, usually much longer than, rarely subequal to tarsus III; ratio of femurogenu IV to tarsus IV, 1:2.0 to 1:6.2.

Key to the Subgenera of *Neopygmephorus* (Females)

1(*a*). With one pair of dorsal propodosomals; two pairs of setae on posterior segment; first hysterosomal tergum covering at least posterior three-fifths of propodosoma (depending upon mount); tarsus IV short, ratio of femurogenu IV to tarsus IV about 1:2.0
Allopygmephorus, new subgenus, p. 228

1(*b*). With two pairs of dorsal propodosomals; two (rarely) or three pairs of setae on posterior segment; first hysterosomal tergum covering at most posterior half of propodosoma; tarsus IV longer, ratio of femurogenu IV to tarsus IV rarely less than 1:2.5
Neopygmephorus, sensu stricto, p. 230

Allopygmephorus, new subgenus

(Figs. 95-96)

Type, *Pygmephorus matthesi* Krczal, 1959.

This subgenus includes *N.* (*A.*) *matthesi* and at least one closely related, undescribed form[35] in the author's collection. All are phoretic upon various Hydrophilidae (Coleoptera). These mites resemble some Microdispini in lacking one pair of propodosomal dorsals and in the loss of a pair of setae from segment V, in often possessing enlarged poststernals, and because the most lateral portions of the posterior ventral plate are striate. They differ from the Microdispini and resemble *Neopygmephorus* in the conformation of the legs, the presence of a modified seta on trochanter I, the arrangement of the setae of the posterior ventral plate, the shape of the propodosomal dorsum, and in the position and shape of the

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[35] The author has two forms which he considers to be separate species. Both follow Krczal's description and illustrations of *matthesi* closely yet exhibit strong setational and minor structural differences.

peritremes. Two species placed herein in the subgenus *Neopygmephorus* likewise lack a pair of setae on segment V and possess short tarsi IV. They are possibly intermediates between the two subgenera.

DIAGNOSIS. In above key.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 140 to 220μ; width not ascertainable; distance between anterior sternocoxal condyles of coxae III 70 to 90μ; posterior ventral plate without integumental engravings but striate on most lateral portions.

Propodosoma. Dorsum. Only anterior pseudostigmatal setae present, these arising between peritremes and pseudostigmata; dorsum nearly to completely covered by first hysterosomal tergum. *Venter.* Internal ventrals I anterior to or in transverse line with external ventrals I[36]; external ventrals I not furcate; secondary transverse suture absent.

Hysterosoma. Dorsum. Fifth segment with only two pairs of apicoventral setae. *Venter.* External presternals not more than one areolar diameter behind line drawn between internal presternal and corresponding first axillary; external poststernal arising less than half the basal width of coxa IV behind posteromedial sclerotization of fourth coxal foramen; apodemes IV indistinct or extending only about halfway to mesal margins of coxal foramina III; distance along posterior median apodeme between junctions of apodemes III and IV short, less than 13μ.

Legs. Short and stout; tibiotarsus I less than twice as long as wide; mediolateral, dorsal sclerotized area circular, distinct; claws IV well developed, simple and more slender but nearly as long as claws III; ratio of length to width of trochanter III about 1:1.8 to 1:2.0; ratio of length to width of coxa IV about 1:2.0 to 1:2.2; ratio of length to width of trochanter IV about 1:2.4 to 1:3.0; tarsus IV short and stout, ratio, length femurogenu IV to tarsus IV, 1:2.0 to 1:2.4; trochanter IV distinctly shorter than coxa IV.

HABITS. Nothing is known of the habits of these mites. They are capable, presumably, of spending considerable periods of time under water. The specimens of *Paracymus* (below) were captured while submerged.

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[36] Krczal's drawing of *matthesi* shows internal sternals I to be posterior to the externals. The propodosoma of this specimen is tipped, however, and it is probable that these setae are in a transverse line.

SPECIMENS EXAMINED. *Species No. 1.* MISSOURI: Weldon Springs, 1 ♀ from *Tropisternus blatchleyi* D'Orchymont. *Species No. 2.* KANSAS: Muscotah, 2 ♀ ♀ from beneath pronotum of *Paracymus* sp.[37]

Subgenus *Neopygmephorus sensu stricto*

(Figs. 97-100)

Type, *Pygmephorus blumentritti* Krczal, 1959.

The present author places in this subgenus the forms considered by most American workers to be "typical" members of the genus *Pygmephorus.* The group is large. Krczal (1959b), includes about fifteen species considered herein to belong to *Neopygmephorus s. str.* Approximately 12 additional species, all undescribed, are in the possession of the present author.

DIAGNOSIS. See key above.

DESCRIPTION OF NON-GRAVID FEMALE. Length, 212 to 385μ; width, 115 to 220μ; distance between anterior sternocoxal condyles III, 70 to 150μ.

Propodosoma. Dorsum. Posterior margin to posterior half covered by first hysterosomal tergum; two pars of propodosomal setae; peritremes located in mesal third of propodosoma.

Hysterosoma. Venter. Apodemes IV joining coxal foramina III at anterior third or quarter, if not, then joining posterior median apodeme on or above line drawn between anteriormost margins of coxal foramina III; external poststernals usually behind posteromesal sclerotization of coxa IV by at least half the basal width of the coxa; distance along posterior median apodeme between junctions of apodemes III and IV usually longer than 13μ.

Legs. Tibiotarsus I elongate, always at least twice as long as wide; ratio, length to width of trochanter III, 1:2.4 to 1:4.1; ratio, length to width of coxa IV, 1:2.0 to 1:3.1; ratio, length to width of trochanter IV, 1:2.5 to 1:4.5; tarsus IV moderately elongate to elongate, 25 to 100μ long, ratio of femurogenu IV to tarsus IV 1:2.8 to 1:6.2.

Species thought to belong to *Neopygmephorus s. str.*

amplus (Krczal, 1959) (*Pygmephorus*)
arboris (Krczal, 1959) (*Pygmephorus*)
bavaricus (Krczal, 1959) (*Pygmephorus*)
blumentritti (Krczal, 1959) (*Pygmephorus*)
comatus (Krczal, 1959) (*Pygmephorus*)

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[37] Det. F. N. Young, Indiana University.

cultratus (Berlese, 1904) (*Pygmephorus*)
cultratus var. *minor* (Berlese, 1904) (*Pygmephorus*)
delanyi (Evans, 1950) (*Pygmephorus*)
ellipticus (Krczal, 1959) (*Pygmephorus*)
formosus (Jacot, 1936) (*Pygmephorus*)
gracilis (Krczal, 1958) (*Pygmephorus*)
lithobii (Krczal, 1958) (*Pygmephorus*)
matthesi (Krczal, 1959) (*Pygmephorus*)
montanus (Willmann, 1956) (*Pygmephorus*)
pannonicus (Willmann, 1951) (*Pygmephorus*)
pratensis (Krczal, 1959) (*Pygmephorus*)
scutacaroides (Vitzthum, 1925) (*Microdispodides*)
tumidosetosus (Willmann, 1951) (*Pygmephorus*)

HABITS. Nothing is known of the habits of the species in this group. Their macrohabitats are similar to those of *Pseudopygmephorus*. Two species, *lithobii* and *amplus*, are known respectively from *Lithobius* (Chilopoda) and from the nest of a "wild bee." Other species are found in soil or litter in assocation with decaying plant material or in the nests of small rodents, insectivores, and birds.

SPECIMENS EXAMINED. Fourteen species, including *blumentritti*, from various parts of the United States including Alaska and from West Australia, from the following situations or hosts: humus in mixed white pine and hemlock forest, litter from fallen *Tilia americana* L., leaf litter in alder swamp, melly leaf litter and moss (Australia), abandoned nest of field mouse, occupied nest of *Peromyscus* sp. (Cricetidae), from "mouse nest," from nest of *Microtus* sp. (Cricetidae), from nest of *Pitymys pinetorum scalopsoides* (Aububon and Bachman) (Cricetidae), debris from nest of *Neotoma* sp. (Cricetidae), debris in nest of *Colaptes cafer* (Gmelin) (Piciformes), from hooded warbler (Parulidae), from *Microtus ochrogaster* (Wagner) (Cricetidae), from tundra, from soil, moss, "*Brachystachium* sp.," under bark of apple, punky stump, from tideline detritus.

LITERATURE CITED

ALFARO, A.

1946. El ácaro *Pediculopsis graminum* Reuter y el hongo *Nigrospora oryzae* (Berk. & Br.), en asociación parasitaria sobre trigos aragonenses. Boletín de Patologia Vegetal y Entomología Agricola de Madrid, 14:321-334.

AMERLING, C.

1861. Die Milbenkrankheit unserer Getreidearten. Lotos, Zeitschrift für Naturwissenschaften, 11:24-27.

1862. Ueber die Naturökonomie der von ihm beobachtungen Milben, inbesondere der Trombidien. Sitzungsberichte Boehmische Gesellschaft der Wissenschaften (= Česka Společnost Nauk, Prague), 1862, pp. 54-56.

ATHIAS-HENRIOT, C.

1961. *Pygmephorus dominguezi,* nouveau Pyémotide algérien (Acariformes, Tarsonemini). Acarologia, 3(4):571-574.

BAKER, E. W., and G. W. WHARTON.

1952. An introduction to acarology. xii + 465 pp. The MacMillan Co., New York.

BANKS, N.

1905a. A treatise on the Acarina, or mites. Proc. U. S. N. M., 28:1-114.

1905b. Descriptions of some new mites. Proc. Ent. Soc. Washington, 7:133-142.

1915. The Acarina or mites. U. S. D. A. Reports, 108:1-153.

BEER, R. E.

1954. A revision of the Tarsonemidae of the western hemisphere (Order Acarina). Univ. Kansas Sci. Bull., 36:1091-1387.

BEER, R. E. and E. A. CROSS

1960. A new genus and two new species of scutacarid mites (Acarina) phoretic upon bees. Jour. Kansas Ent. Soc., 33:49-57.

BERLESE, A.

1885. Acarorum systematis specimen. Bolletino della Societá Entomologica Italiana, 17:125-135.

1886. La Sottofamiglia dei Tarsonemidi. Ibid., 18-334-354.

1895. Acari, Myriapoda, Scorpiones, huscusque in Italia reperta. Fasc. 75, vols. 1-8, Padova.

1897-99. Gli Acari agrarii. Rivista Patologia Vegetale, 6:1-65; 7:312-344.

1904a. Acari nuovi. Manipulus III. Redia, 2:10-32.

1904b. Diagnosi di alcune nuove specie di Acari Italiani, mirmecofilie liberi. Zoologischer Anzeiger, 27:12-28.

1911. Alcuni acari entomofili nuovi. Redia, 7:183-186.

1925. Gli Insetti. Vol. 2, Vita e Costumi. ix + 992 pp., Societá Editrice Libraria, Milano.

BIGELOW, R. S.

1958. Classification and phylogeny. Systematic Zool., 7(2):49-59.

BLANC, G.

1912-13. Revue generale de la famille des Tarsonémides. Bulletin de la Société d'Etudes de Vulgarisation de la Zoologie Agricole, Bordeaux, 11(6):153-163 (*Pediculoides*), also 12(1):14-18 (*Pediculopsis*), and 12(2):41-50, (Tarsonemidae).

BRADBURY, O. C.

1926. Some phases of the embryology of the carnation mite. Jour. Elisha Mitchell Scientific Soc., 42:94-98.

BRUCKER, E. A.

1899. Sur *Pediculoides ventricosus* Newport. Compte Rendus Hebdomaires des Sèances et Memoires de la Société de Biologie (12)9: 953-955.

1901. Monographie de *Pediculoides ventricosus* Newport et theorie des pièces buccales des acariens. Bulletin Scientifique de la France et de la Belgique, (6)35(4):365-451.

CANESTRINI, G.

1888. Prospetto dell'Acarofauna Italiana. Vol. 3, famiglie Tarsonemini e Tiroglifini e appendice agli Analgesini, pp. 309-425.

1891. Abbozzo del Sistema Acarologico. Atti del Reale Instituto Veneto di Scienze, Lettere, ed Arti, (7)2(1):699-725.

CANESTRINI, G. and A. BERLESE

1884. Sopra alcune nuove specie di Acari Italiana. Atti della Societá Veneto-Trentino di Scienze Naturali, 9:175-182.

CANESTRINI, G. and F. FANZAGO

1876. Nuovi Acari Italiani. Ibid., 5:99-111 and 130-142.

CANESTRINI, R.

1880. Contribuzione allo studio degli Acari Parassiti degli Insetti. Ibid. vol. 7:154-178.

COOPER, K. W.

1937. Reproductive behaviour and haploid parthenogenesis in the grass mite *Pediculopsis graminum* (Reuter) (Acarina, Tarsonemidae). Proc. Nat'l. Acad. Sci., 23(2):41-44.

1939. The nuclear cytology of the grass mite, *Pediculopsis graminum* (Reut.) with special reference to karyomerokinesis. Zeitschrift für Zellforschung und Mikroskopische Anatomie, Abt. B., Chromosoma, Zeitschrift für Zellkern- und Chromosomenforschung, 1:51-103.

1940. Relations of *Pediculopsis graminum* and *Fusarium poae* to central bud rot of carnations. Phytopathology, 30(10):853-859.

CUNLIFFE, F.

1955. A proposed classification of the trombidiform mites (Acarina). Proc. Ent. Soc. Washington, 57:209-218.

DEBEY, M. H.

1849. Ueber mehrere Acarus-Arten. Amtlicher Bericht 25, Versammlung der Gesellschaft Deutscher Naturforscher und Aerzte, Aachen, pp. 155-156.

DEBIA, P.

1838. Sur les mites ou acarus d. vielles criblures. Recueil Agronomique de Tarn et Garonne, 19:149.

DEFILIPPI, F.

1861. *Lais:* nuovo genere di Acari della tribu de Gamasidi. Archivio per la Zoologia, l'Anatomia, e la Fisiologia, 1:211-215.

EVANS, G. O.

1952. Terrestrial mites new to Britain. II. Ann. & Mag. Nat. Hist., (12)5(55):660-675.

EWING, H. E.

1912. The origin and significance of parasitism in the Acarina. Trans. Acad. Sci. St. Louis, 21:1-70.

1917. New Acarina. Part II—Descriptions of new species and varieties from Iowa, Missouri, Illinois, Indiana, and Ohio. Amer. Mus. Nat. Hist. Bull., 37:167-169.

FROGGATT, W. W.

1894. Description of a new mite belonging to the genus *Heteropus,* found in wasps' nests. Proc. Linn. Soc. New South Wales, (2)9: 259-260.

GEBER, E.

1879. Entzundliche Prozesse der Haut durch eine bis Jetzt nicht bestimmte Milbe verursacht. Wiener Medizinische Presse, Jahrg. 20 (3 Fortsetzungen):1362-1365, 1395-1397, 1428-1429.

GISLÉN, T.

1940. The number of animal species in Sweden with remarks on some rules of distribution, especially of the microfauna. Lunds Universitets Årsskrift, N. F. Avd. (2)36(2):3-23 (Kungl. Fysiografiska Sällskapets Handlingar N. F. 51(2).

GOKSU, K., G. W. WHARTON, and C. E. YUNKER

1960. Variation in populations of laboratory-reared *Trombicula (Leptotrombidium) akamushi* (Acarina: Trombiculidae). Acarologia, 2:199-209.

HALLER, G.

1881. Die Mundtheile und Systematische Stellung der Milben. Zoologischer Anzeiger, 4:380-386.

1882. Beitrag zur Kenntniss der Milbenfauna Württembergs. Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg, 1882, pp. 293-325.

HARTIG, T.

1834. In G. L. & T. Hartig's Forstliches und Forstnaturwissenschaftliche Conversationslexikon, Berlin, pp. 733-737.

HEALD, F. D.

1906a. Report on the plant diseases prevalent in Nebraska during the season of 1905. Nebraska Exp. Sta. Rep., 19:55, 79.

1906b. Bud-rot of carnations. Science, (N. S.) 23:620.

HERFS, A.

1926. Ökologische Untersuchungen an *Pediculoides ventricosus* (Newp.) Berlese. Zoologia. Original-Abhandlungen aus dem Gesamtgebiete der Zoologie, 74:3-68.

HIRST, S.

1921. On some new or little-known acari, mostly parasitic in habit. Proc. Zool. Soc., London, 1921, (II):357-378.

HOFFMANN, W. H.

1923a. Über *Triatoma flavida,* eine kubanische Reduviide. Munchen medizinische Wochenschrift, 70:603. *Also* see Zoologischer Bericht, Bd. 3.

1923b. Observations on the occurrence and biology of *Triatoma flavida* in Cuba (Heteropt., Reduviidae). Ent. News 34:111-113.

HUGHES, A. M.

1948. The mites associated with stored food products. Ministry of Agriculture & Fisheries. His Majesty's Stationery Office, London, pp. 1-168.

HULL, J. E.

1921. Some new mites. The Vasculum, 1921, pp. 17-18.

HUNTER, W. D. and W. E. HINDS

1905. The Mexican cotton boll weevil. U. S. D. A., Bureau of Entomology, Bull. no. 51, 181 pp.

JACOT, A. P.

1936a. An undescribed pediculoidid mite from the southern Appalachians. Canadian Ent., 68:82-85.

1936b. Three undescribed pediculoidid mites from the southern Appalachians. Canadian Ent., 68:129-133.

KARAFIAT, H.

1959. Systematik und Ökologie der Scutacariden. Beiträge zur Systematik und Ökologie mitteleuropaischer Acarina, Bd.1: Tyroglyphidae und Tarsonemini, Teil 2, pp. 627-712.

KAUFMANN, O.

1924. Die Weissährigkeit der Wiesengraser und ihre Bekampfung. Nachrichtenblatt für die Deutschen Pflanzenschutzdienst (= Berlin Biologische Reichanstalt für Land- und Forstwirtschaft), 4(1):1-2.

KIRCHNER

1864. Die Milben (Acari) Böhmens (3 Fortestzung). Lotos, Zeitschrift für Naturwissenschaften, 14(8):125-126.

KOLLER, G.

1882a. Eine Getreide-Milbe als Krankheitserregerin. Pester medizinisch-chirurgische Presse. *Also* see Biologisches Zentralblatt, III:127.

1882b. Gabonán élösködö atkafaj álezái által okozott börbetegség újabb esetei. Orvosi Hetilap, 26:821-822.

KRAMER, P.

1877a. Grundzuge zur Systematik der Milben. Archiv für Naturgeschichte, 43:215-247.

1877b. Zwei Parasitische Milben des Maulwurfs. Ibid., 43:249-295.

KRANTZ, G. W.

1957. *Dolichocybe keiferi,* a new genus and new species of pyemotid mite, with a description of a new species of *Siteroptes* (Acarina: Pyemotidae). Ann. Ent. Soc. Amer., 50:259-264.

1959. A redescription of the male of *Siteroptes reniformis* Krantz 1957 with notes on the family Pyemotidae (Acarina). Ibid., 52:335-337.

KRCZAL, H.

1958. Einige neue, nordschwedische Milben-Arten der Gattung *Pygmephorus.* Statens Växtskyddsanstalt. Meddelanden, 11(72):61-80.

1959a. *Pyemotes boylei,* eine neue Pymotide aus Hawaii. Zoologischer Anzeiger, 163:148-152.

1959b. Systematik und Ökologie der Pyemotiden. Beiträge zur Systematik und Ökologie mitteleuropaischer Acarina, Band I: Tyroglyphidae und Tarsonemini, Teil 2, pp. 385-625.

LABOULBÈNE, A. and P. MEGNIN

1885a. Note sur un Acarien utile, le *Sphaerogyna ventricosa* Newport. Comptes Rendus Hebdomaires des Séances et Mémoires de la Société de Biologie, (8)2:282-285.

1885b. Memoire sur le *Sphaerogyna ventricosa* (Newport). Journal de L'Anatomie et de la Physiologie Normales et Pathologiques de l'Homme et de Animaux, 21:1-18.

LAGRÈZE-FOSSOT, A. and R. J. MONTAGNÉ

1851. Sur la mite du blé. Recueil Agronomique de la Société des Sciences, Agriculture et Belles Lettres, 32(2).

LAWRENCE, R. F.

1940. Three new parasitic mites (Acarina) from South Africa. Jour. of the Ent. Soc. South Africa, 3:107-111.

LICHTENSTEIN, J.

1868. *In* séance, 9 September, Annales de la Société Entomologique de France, Bulletin des Séances et Bulletin Bibliographique, (4)37: LXXXVI.

1869. *In* séance, 22 December, Ibid., (4)9:LXXVIII.

1875. *In* séance, 23 June. Ibid., (5)5:CXXVIII (*not* CXXXVIII).

LINDROTH, C. H.

1957. The faunal connections between Europe and North America. 344 pp. Wiley & Sons, New York, and Almqvist and Wiksell, Stockholm.

LIPOVSKY, L. J.

1953. Polyvinyl alcohol with lacto-phenol; a mounting and clearing medium for chigger mites. Ent. News, 64:42-44.

LOMBARDINI, G.

1949. Acari Nuovi. Redia, 34:67-74.

1953. Acari Nuovi XXIX. Ibid., 38:181-194.

MARLATT, C. L.

1898. The periodical cicada. U. S. D. A. Div. Ent., Bull. No. 14, new series, 118 pp.

MASLIN, P.

1952. Morphological criteria of phyletic relationships. Systematic Zool., 1:49-70.

MAYR, E.

1942. Systematics and the origin of species from the viewpoint of a zoologist. xiv + 334 pp., Columbia University Press, New York.

MAYR, E., E. G. LINSLEY, and R. L. USINGER

1953. Methods and principles of systematic zoology. ix + 336 pp., McGraw-Hill, Inc., New York, Toronto, London.

MICHAEL, A.

1880. On two species of Acarina. Jour. Quekett Microscopical Club, 6(44):113-120.

1890. Report on diseased sugar-cane from Barbados, forwarded by Mr. John R. Bovell. Mites on sugar-cane. Bull., Royal Garden, Kew, no. 40, April, pp. 85-86. Also, *see* Barbadoes sugar cane mites. Insect Life, 3(1):31.

MICHENER, C. D.

1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). Bull. Amer. Mus. Nat. Hist. 82(6): 138-326.

1957. Some bases for higher categories in classification. Syst. Zool., 6(4):130-162.

MICHENER, C. D., and R. R. SOKAL

1957. A quantitative approach to a problem in classification. Evolution, 11(2):130-162.

MITCHELL, R. D.

1955. Anatomy, life history, and evolution of the mites parasitizing fresh-water mussels. Misc. Pubs., Mus. Zool., Univ. of Michigan, 89:1-26.

1958. The evolution of exoskeletons and mite phylogeny. Proc. X Int. Cong. Ent., 1:853-855.

MOLZ, E., and O. MORGENTHALER

1912. Die *Sporotrichum* Knospenfäule, eine für Deutschland neue Nelkenkrankheit. (Zugleich ein Fall von Symbiose). Bericht der Deutschen Botanischen Gesellschaft, 30:654-662.

MONTEROSSO, B.

1934. Osservazioni e Riccerche Sperimentali sulla Biologia di *Pediculoides ventricosus* (Newp.) Berlese. Rivista di Biologia, 16:80-127.

MORGENTHALER, O.

1922. Chapter "Bienen und Milben." Archiv für Bienenkunde. 4(2): 45-52.

MÜLLER, J.

1905. *Pediculoides avenae* n. sp. noch eine Milbenkrankheit des Hafers. Zeitschrift für Pflanzenkrankheiten, 15:23-29.

NEWPORT, G.

1850. Further observations on the habits of *Monodontomerus,* with some account of a new Acarus, *Heteropus ventricosus,* a parasite in the nests of *Anthophora retusa.* Proc. Linn. Soc. London, 2:70. Paper read March 5, 1850. Also *see* Annals & Magazine of Natural History, (2)6:395-396.

1853. *Heteropus ventricosus,* n. gen., n. sp. Further observations on the habits of *Monodontomerus;* with account of a new Acarus (*Heteropus ventricosus*), a parasite in the nests of *Anthophora retusa.* Trans. Linn. Soc. London, 21(2):95-102.

NEWSTEAD, R. and H. M. DUVALL

1918. Bionomic, morphological, and economic report on the acarids of stored grain and flour. Royal Soc. Rep. of Grain Pests (War) Committee, 2:19-25.

OUDEMANS, A. C.

1906. Acarologische Aanteekeningen XXI. Entomologische Berichten uitgegeven door de Nederlandsche Entomologische Vereeniging, 27:37-46.

1912. Acarologische Aanteekeningen XL. Ibid., 3:231-236.

1913. Acarologisches aus Maulwurfsnestern (2 Fortsetzung). Archiv für Naturgeschichte, Abt. A, 79(9):68-136.

1915. Notizen über Acari XXII Reihe (Uropodidae, Tarsonemidae, Bdellidae). Ibid., Abt. A, 81(5):38-41.

1917. Acarologische Aanteekeningen LXI. Entomologische Berichten uitgegeven door de Nederlandsche Entomologische Vereeniging, 4(93):316 and 331-332.

1931. Acarologische Aanteekeningen CXI (Revisie der Tarsonemini Canestrini & Fanzago, 1877). Ibid., 8(182):312-331.

1936. Neues über *Pediculoides* Targ.-Tozz. 1878. Festschrift für Embrik Strand, 1:391-404.

1937a. Tijdschrift voor Entomologie uitgegeven door de Nederlandsche Entomologische Vereeniging, 80, Verslag, IV-VIII.

1937b. Kritisch historisch Overzicht der Acarologie, Band C: Tarsonemini, Stomatostigmata, Eleutherengona. I-XXIII and pp. 799-1348, E. J. Brill, Leiden.

PAOLI, G.

1911. Monografia dei Tarsonemidi. Redia, 7:217-281, pl. 7-11.

PÄTAU, K.

1936. Cytologische Untersuchungen an der haploidparthogenetischen Milbe *Pediculoides ventricosus* Newp. Berl. Zoologische Jahrbucher, Abteilung für Allgemeine Zoologie und Physiologie der Tiere, 56: 277-321.

PIERSIG, R.

1901. Review of Brucker, 1901. Zoologisches Zentralblatt, 9(1):19-25.

RACK, G.

1959. *Acarophenax dermestidarum* sp. n. (Acarina, Pyemotidae), ein Eiparasit von *Dermestes*-arten. Zeitschrift für Parasitenkunde, 19:411-431.

REDIKORTSEV, V. V.

1947. The mite *Pediculoides ipidarius* sp. nov., a parasite of bark beetles. Entomologicheskoe Obozrenie, 129(3-4):247-249.

REUTER, E.

1900. Untersuchungen über die Ursachen der Weissährigkeit an Wiesengräsern in Finland. Acta Societatis pro Fauna et Flora Fennica, 19(1):23-136.

1903. Weissährigkeit der Getreidearten. Zeitschrift für Pflanzenkrankheiten, 12:324-338.

1907. Über die Eibildung bei der Milbe *Pediculopsis graminum* (E. Reuter) zugleich ein Beitrag zur Frage der Schlechtsbestimmung. Festschrift für J. A. Palmen, no. 7, pp. 3-39.

1909a. Zur Morphologie und Ontogenie der Acariden mit besonderer Berücksichtigung von *Pediculopsis graminum* (E. Reuter). Acta Societa Scientiarum Fennicae, 36(4):1-287.

1909b. Merokinesis, ein neuer Kernteilungsmodus. Acta Societa pro Fauna et Flora Fennica, 37.

RICHARDS, A. G.

1951. The integument of arthropods. ix + 411 pp., Univ. of Minnesota Press, Minneapolis.

ROVELLI, G. and B. GRASSI

1888. Di un singolare acaride, *Podapolipus reconditus,* nobis. Bolletino della Societá Entomologica Italiana, 20:59-63.

SASA, M.

1947. Contribution to the knowledge of human acariasis. Nisshin Igaku, 34:167-170.

SCHAMBERG, J. F.

1910. Grain itch (acarodermatitis urticarioides): a study of a new disease in this country. Jour. Cutaneous Diseases, Feb., 1910, pp. 67-89.

SELLNICK, M.

1940. Die Milbenfauna Islands. Göteborgs Kungl. vetenskapsoch vitterhetssamhälles handligar (B) 6(11):120-125.

1943. Einige Neue Milben aus der Romagna. Bolletino della Societá Entomologica Italiana. Firenze, Genova, 75:22-26.

SIMPSON, G. G.

1961. Principles of animal taxonomy. Columbia Univ. Press, xii + 247 pp.

SINHA, R. N.

1958. A subgeneric revision of the genus *Osmia* in the western hemisphere (Hymenoptera: Megachilidae). Univ. Kansas Sci. Bull. 39(5):211-261.

STEWART, F. C. and H. E. HODGKISS

1908. The Sporotrichum bud-rot of carnations and the silver top of June grass. New York Agr. Exp. Sta. Tech. Bull. no. 7, pp. 83-119.

TARGIONI-TOZZETTI, A.

1878. Relazione intorno ai lavori della Stazione di Entomologia Agraria di Firenze per l'anno 1876. Annali dell'Agricoltura, I:244-275.

THOR, SIG.

1934. Neue Beiträge zur Kenntnis der Invertebraten Fauna von Svalbard. Zoologischer Anzeiger, 107(5-6):114-139.

TRAGARDH, I.

1904. Acariden aus Agypten und dem Sudan (Zugleich ein Beitrag zur Kenntnis der Entwicklungsgeschichte der Gattungen *Phytoptipalpus, Pimeliaphilus, Pterygosoma,* und *Podapolipus*). Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901. Jagerskiold Expedition 20, pp. 1-124.

TROUESSART, E. L.

1891 and 1896. Considerations générales sur la classification des acariens suivies d'un essai de classification nouvelle. Revue des Sciences naturelles de l'Ouest, 1891, no. 4:289-308. Same title (Suite), Ibid., 1896:20-54.

TRYBOM, R.

1893. *Physacarus ventricosus* Newport, funnen under egendomliga förhållanden. Entomologisk Tidskrift, 14:121-126.

VITZTHUM, G. H.

1914. Beschreibung einiger neuen Milben. Zoologischer Anzeiger, 44(7): 315-328.

1919. Acarologische Beobachtungen 3 Reihe. Archiv für Naturgeschichte, Abt. A., Bd. 85, Heft 5:2.

1923. Acarologische Beobachtungen 7 Reihe. Ibid., Abt. A., 89(2): 97-181.

1924. Acarologische Beobachtungen 8 Reihe. Archiv für Naturgeschichte, 90(10):1-86.

1927. Die Acarofauna der Harzflüsse (Acarologische Beobachtungen 12 Reihe). Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, 1927:89-110.

1929. Acari. Die Tierwelt Mitteleuropas, 3(7):1-112.

1931. Resultats Scientifique de Voyage aux Indes Orientales Néerlandaises. Acarina. Memoires du Musée Royal D'Historie Naturelle de Belgique, vol. 3, fasc. 5, pp. 5-55.

1943. *In* Bronns Klassen und Ordnungen des Tierreichs, Bd. 5 (Arthropoda), Abt. IV (Arachnoidea), Buch 5 (Acarina). XI + 480 pp. Akademische Verlagsgesellschaft, Leipzig.

VON HEYDEN, L.

1835. Etwas über *Xenos.* Amtlicher Bericht 12, Versammlung der Naturforscher und Aerzte, Stuttgart, 1834 (publ. 1835), p. 101.

WEBSTER, F. M.

1883. Observations on the Angoumois grain moth and its parasites. 12th Rep., St. Entomologist on the Noxious and Beneficial Insects of the State of Illinois. Springfield, 1883, pp. 144-154.

1910. A predaceous and supposedly beneficial mite, *Pediculoides* becomes noxious to man. Ann. Ent. Soc. Amer., 3:15-39.

WEISS, H. B.

1915. The occurrence of *Pediculopsis graminum* and the carnation budrot in New Jersey. Ent. News, 26:183.

WHARTON, G. W. and H. S. FULLER

1952. A manual of the chiggers. Memoir Ent. Soc. Washington, no. 4, 185 pp.

WILLMANN, C.

1942. Acari aus Nordwestdeutschen Mooren. Abhandlungen hrsg. Naturwissenschaftlichen Verein zu Bremen, 32(1):163-183.

1943. Terrestrische Milben aus Schwedisch-Lappland. Archiv für Hydrobiologie, 40:216-218.

1949. Über eine eigenartige Milben fauna an faulenden Kartoffeln. Veröffentlichungen aus dem Museum Naturvolker und Handelskunde in Bremen, no. 1A, pp. 136-142.

1951. Untersuchungen über die terrestrische Milbenfauna in pannonischen Klimagebiet Österreichs. Sitzungsberichten Österreichischen Akademie der Wissenschaften, Mathematisch-naturwissenschaftlich Klasse. Abt. I, 160(1&2):91-176.

1952a. Die Milbenfauna der Nordseeinsel Wangerooge. Veroffentlichungen der Institut für Meeresforschung, 1:139-186.

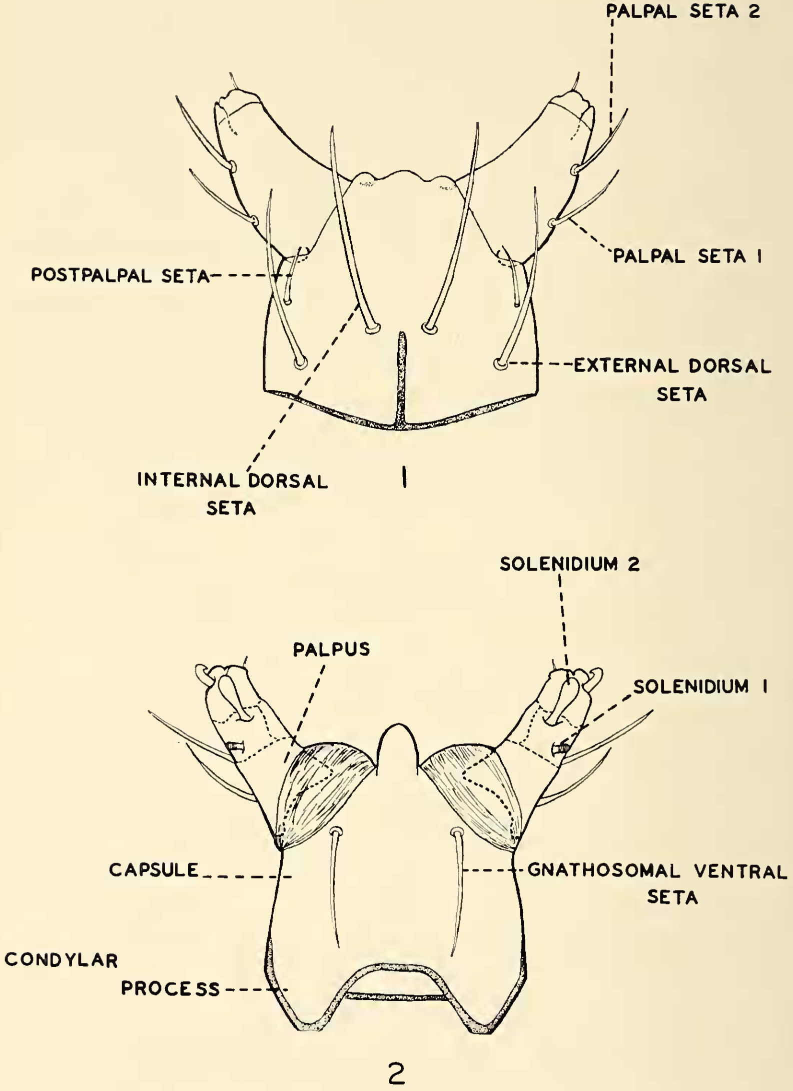
1952b. Parasitische Milben an Kleinsäugern. Zeitschrift für Parasitenkunde, 15:392-428.

1953. Tarsal Sinnesorgane bei der Gattung *Rhagidia* und anderen prostigmatischen Milben. Zoologischer Anzeiger, 150:215-223.

1956. Milben aus dem Naturschutzgebiet auf dem Spieglitzer (Glatzer) Schneeberg. Ceskoslovenska parasitologie, 3:211-273.

WOLCOTT, R. H.

1908. A mite accompanying the bud rot of carnations, Univ. Nebraska Exp. Sta. Bull. no. 103, pp. 25-31.



FIGS. 1-2. Gnathosoma of female *Neopygmephorus* sp., dorsal (fig. 1) and ventral (fig. 2) aspects. Labelled structures agree with the terminology used in the text.

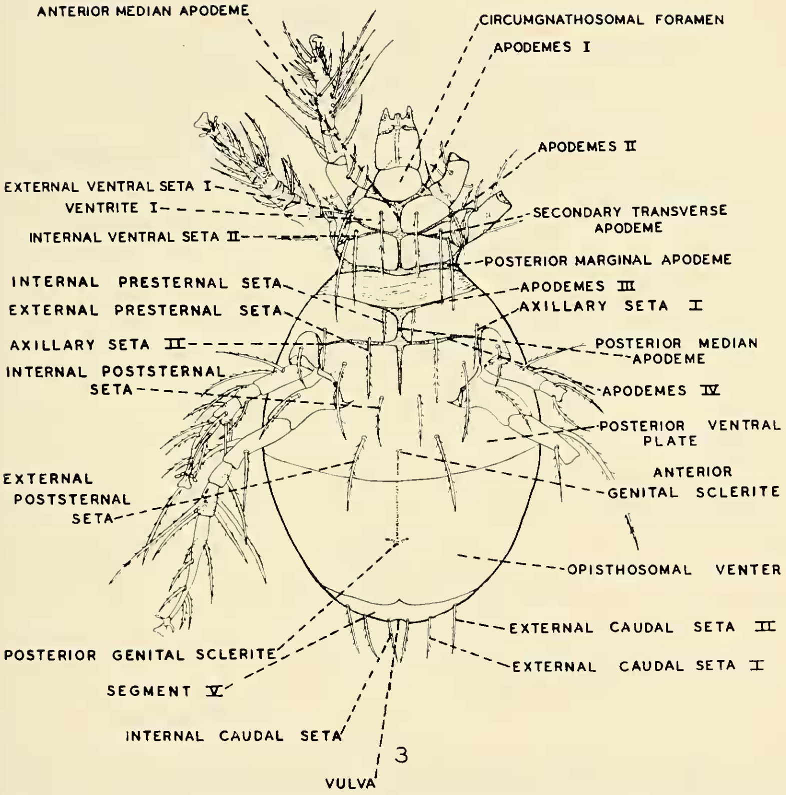


FIG. 3. *Neopygmephorus* sp., female, ventral aspect. Labelled structures agree with the terminology used in the text.

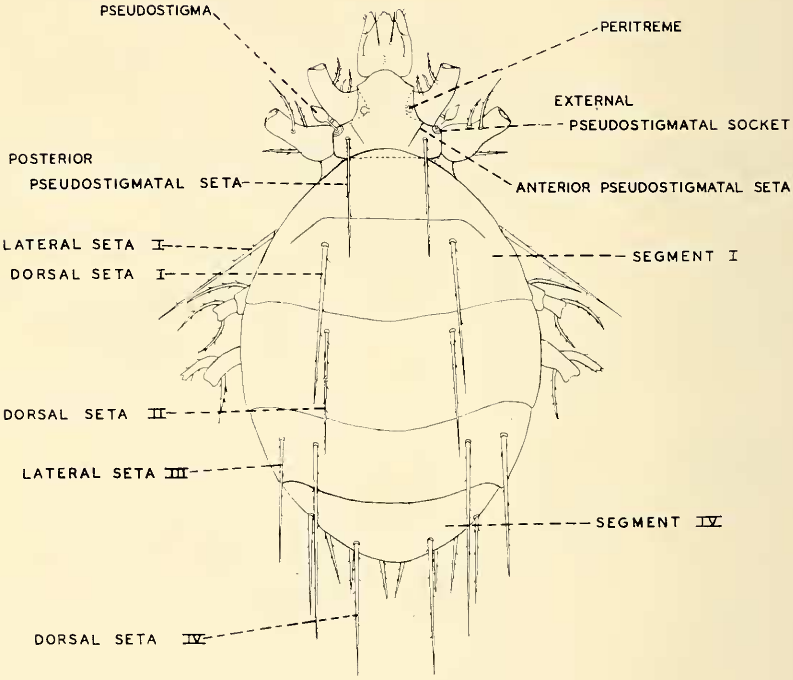


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FIG. 4. *Neopygmephorus* sp., female, dorsal aspect. Labelled structures agree with the terminology used in the text.

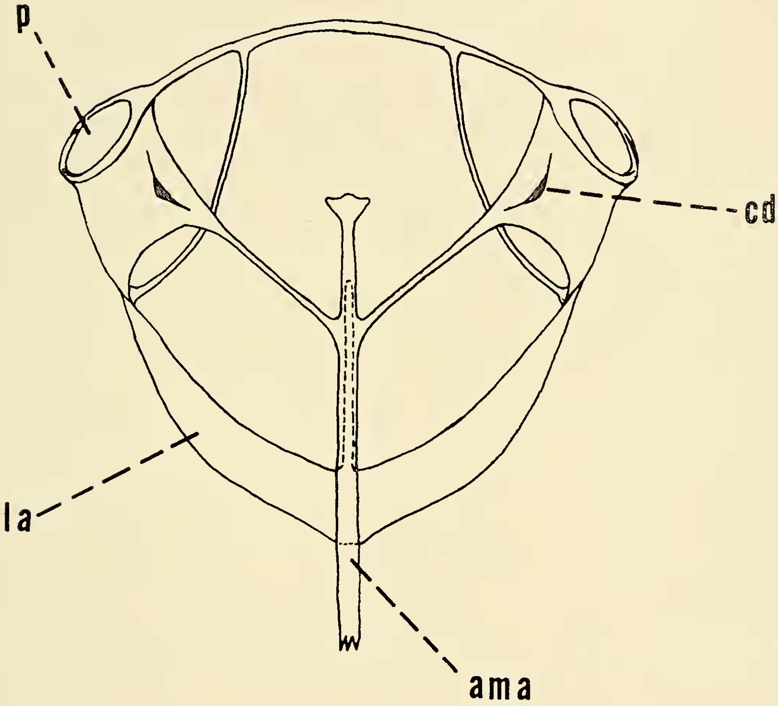

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FIG. 5. Propodosomal arcula of *Adactylidium beeri.* Holotype female, ventral aspect. ama = anterior median apodeme; la = lateral apodeme; cd = anterior condyle of coxa I; p = peritreme.

FIG. 6. Diagram of relationships within the superfamily Tarsonemoidea.

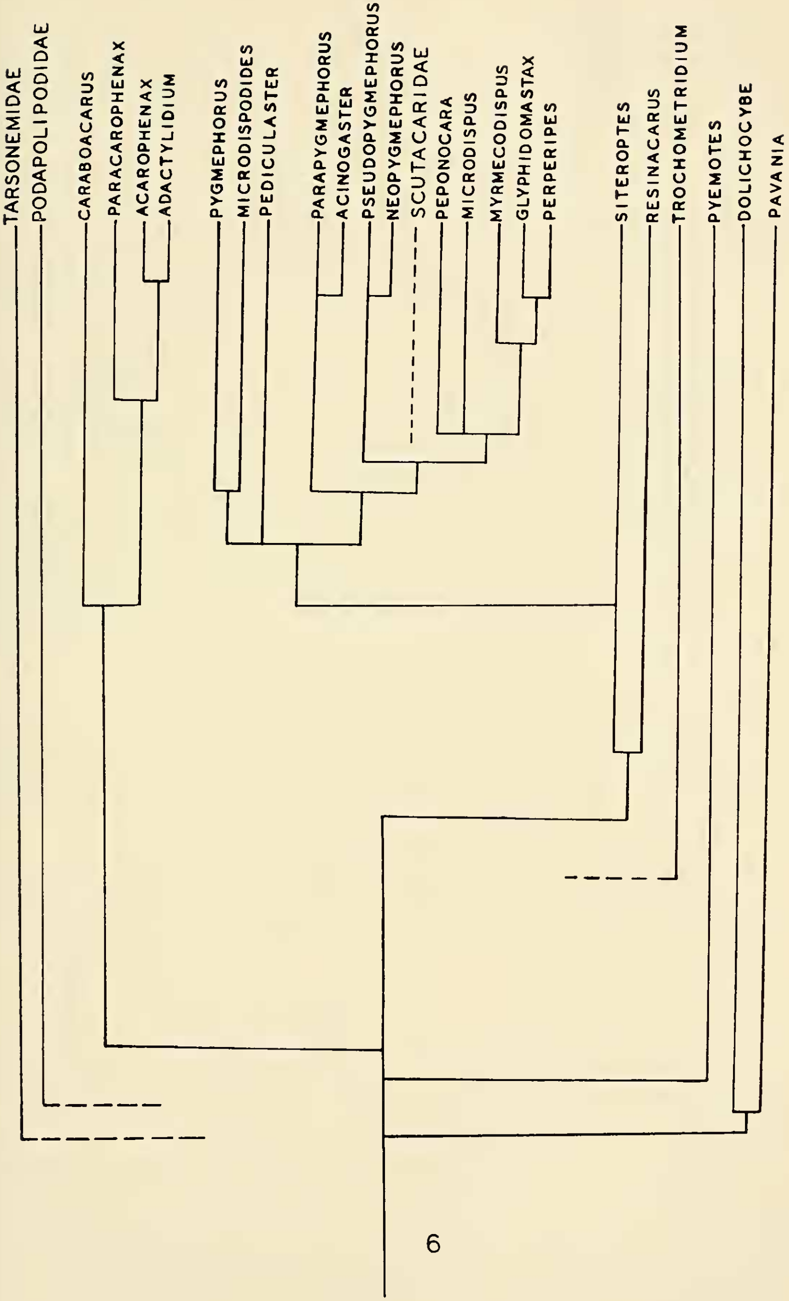

TARSONEMIDAE
PODAPOLIPODIDAE
CARABOACARUS
PARACAROPHENAX
ACAROPHENAX
ADACTYLIDIUM
PYGMEPHORUS
MICRODISPODIDES
PEDICULASTER
PARAPYGMEPHORUS
ACINOGASTER
PSEUDOPYGMEPHORUS
NEOPYGMEPHORUS
SCUTACARIDAE
PEPONOCARA
MICRODISPUS
MYRMECODISPUS
GLYPHIDOMASTAX
PERPERIPES
SITEROPTES
RESINACARUS
TROCHOMETRIDIUM
PYEMOTES
DOLICHOCYBE
PAVANIA
6

FIG. 7. A proposed evolution of the apodemes, setation, and coxae of the posterior ventral plate.

A. Apodemes III and IV oblique, incomplete medially, terminating laterally at anterior sternocoxal condyles III and IV, respectively. Coxae III and IV triangular, similar in shape. (*Pavania, Dolichocybe, Pymotes,* many Acarophenacinae).

B. Apodemes IV complete medially, at least trace of posterior median apodeme present. (*Metasiteroptes macer.*)

C. Similar to (B) but coxa IV differing strongly from coxa III in shape and proximity. (*Siteroptes s. str.*)

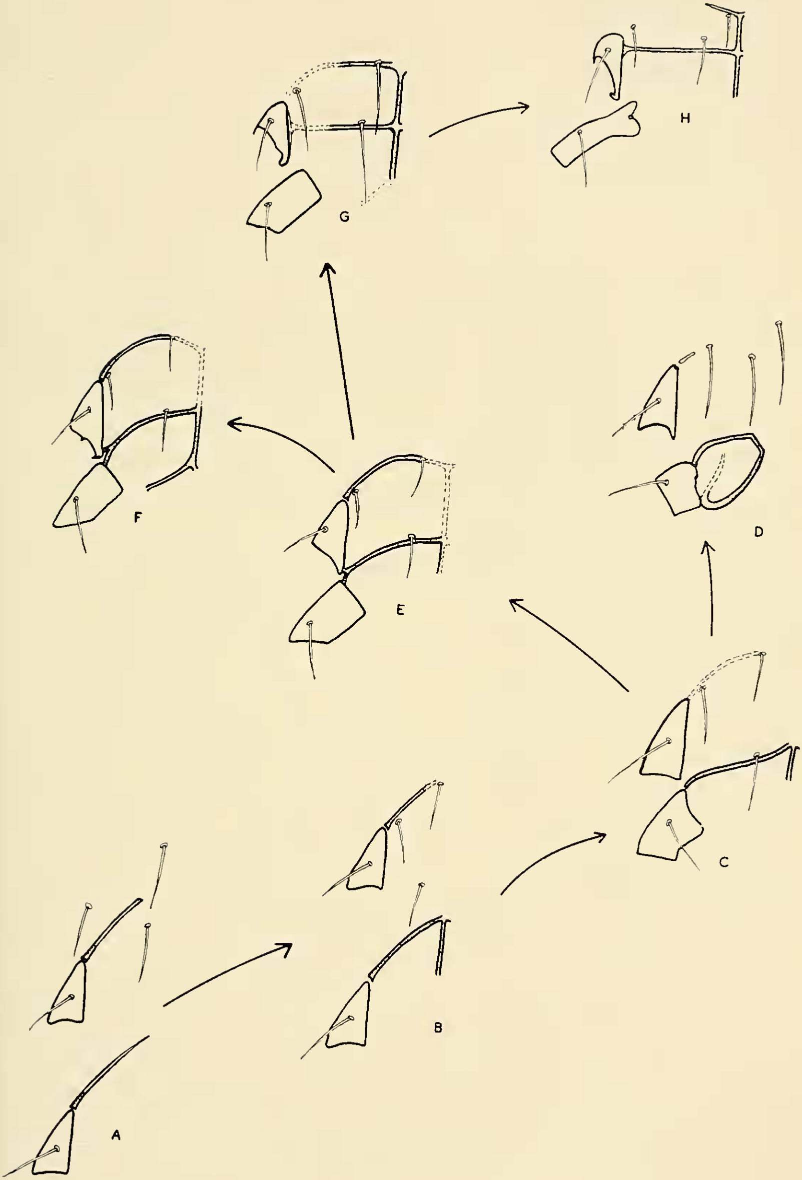
D. Modification of (C) as found in *Trochometridium tribulatum.*

E. Apodemes III and IV usually well developed, complete and joined by posterior median apodeme. Apodeme IV appearing furcate distally, its anterior branch meeting the posterior ventral margin of coxal foramen III, its posterior branch terminating along the anterior dorsal margin of coxal foramen IV. (*Siteroptes s. str., Siteroptoides, Pediculaster.*)

F. As (E) but with apodeme V well developed. (*Siteroptoides, Pediculaster.*)

G. Loss of posterior branch of apodeme IV, anterior migration of superior branch to center of coxal foramen III or beyond. Apodemes III and IV often not complete laterally. Apodemes V may be present. (*Pygmephorus,* most *Microdispini, Parapygmephorus, Pseudopygmephorus.*)

H. Apodemes III incomplete laterally, apodemes IV usually complete and joining the mesal margin of coxal foramen III along its anterior half. Coxa IV elongate and with basal constriction. (*Neopygmephorus.*)



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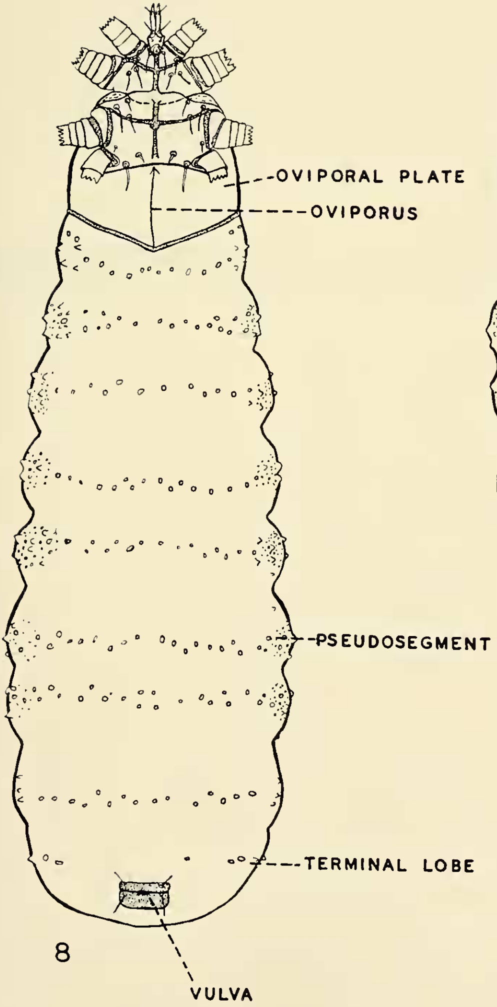
FIGS. 8-9. *Perperipes ornithocephala,* gravid female.


OVIPORAL PLATE
OVIPORUS
PSEUDOSEGMENT
TERMINAL LOBE
VULVA

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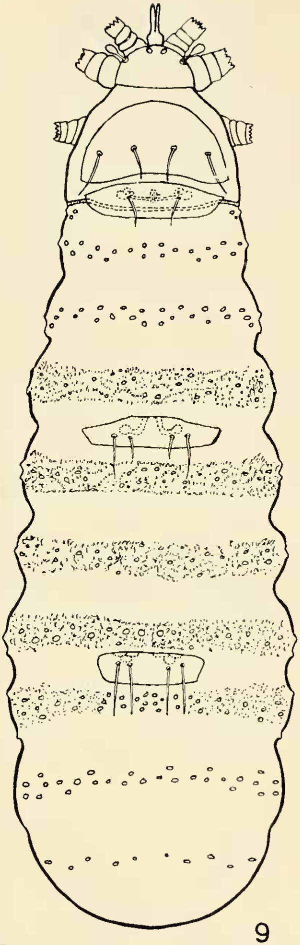

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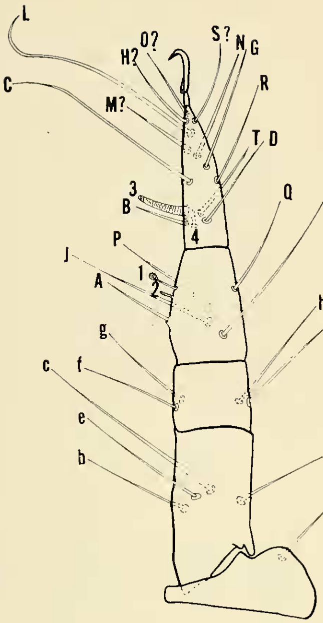
FIGS. 10-12. Legs of *Siteroptes* sp. (nr. *antiquissimus*), ventral aspect, setal nomenclature after Krczal (1959b). Fig. 10, leg I, female. Fig. 11, leg IV, female. Fig. 12, leg I, male.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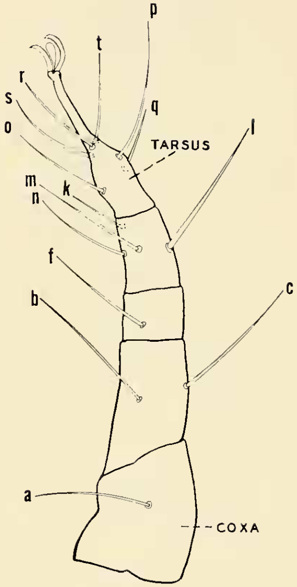
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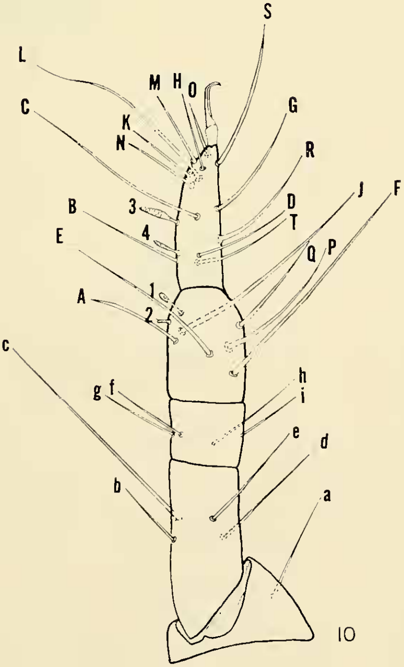
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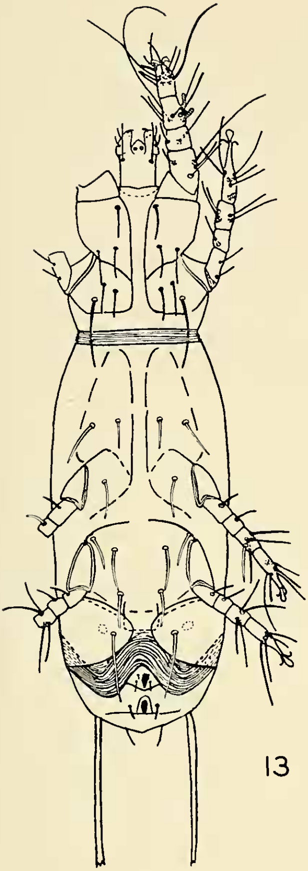
FIGS. 13-16. *Dolichocybe keiferi,* syntypes. Figs. 13-14, female. Figs. 15-16, male.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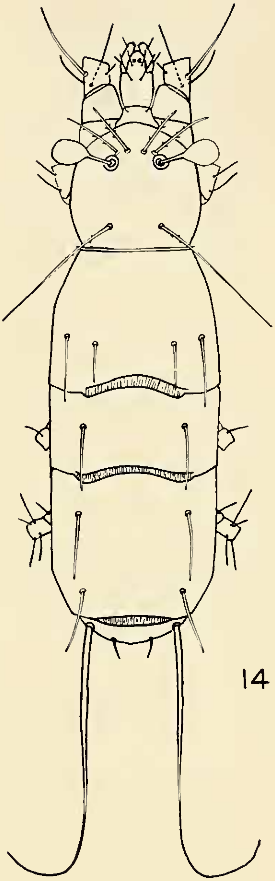
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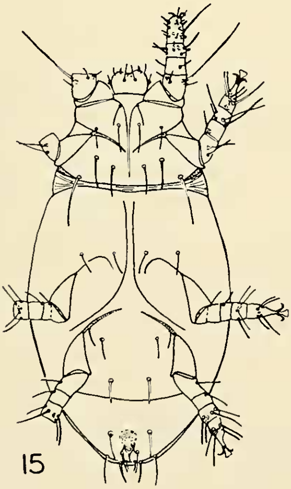
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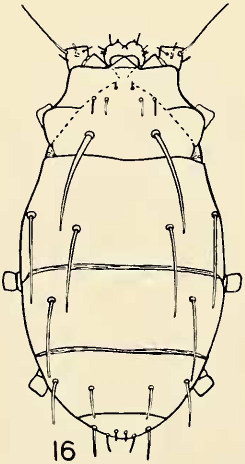
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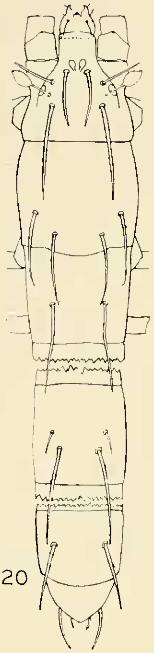
FIGS. 17-18. *Pavania fusiformis,* female syntype.

FIGS. 19-20. *Siteroptes* (*Metasiteroptes*) *macer,* female. Composite, holotype and paratype.



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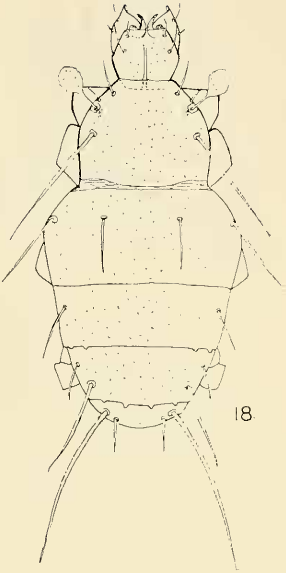

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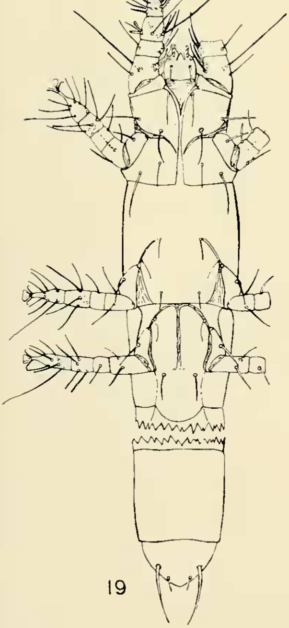

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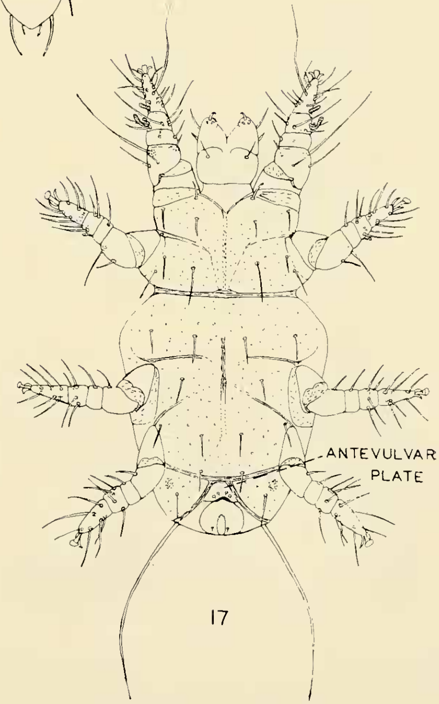

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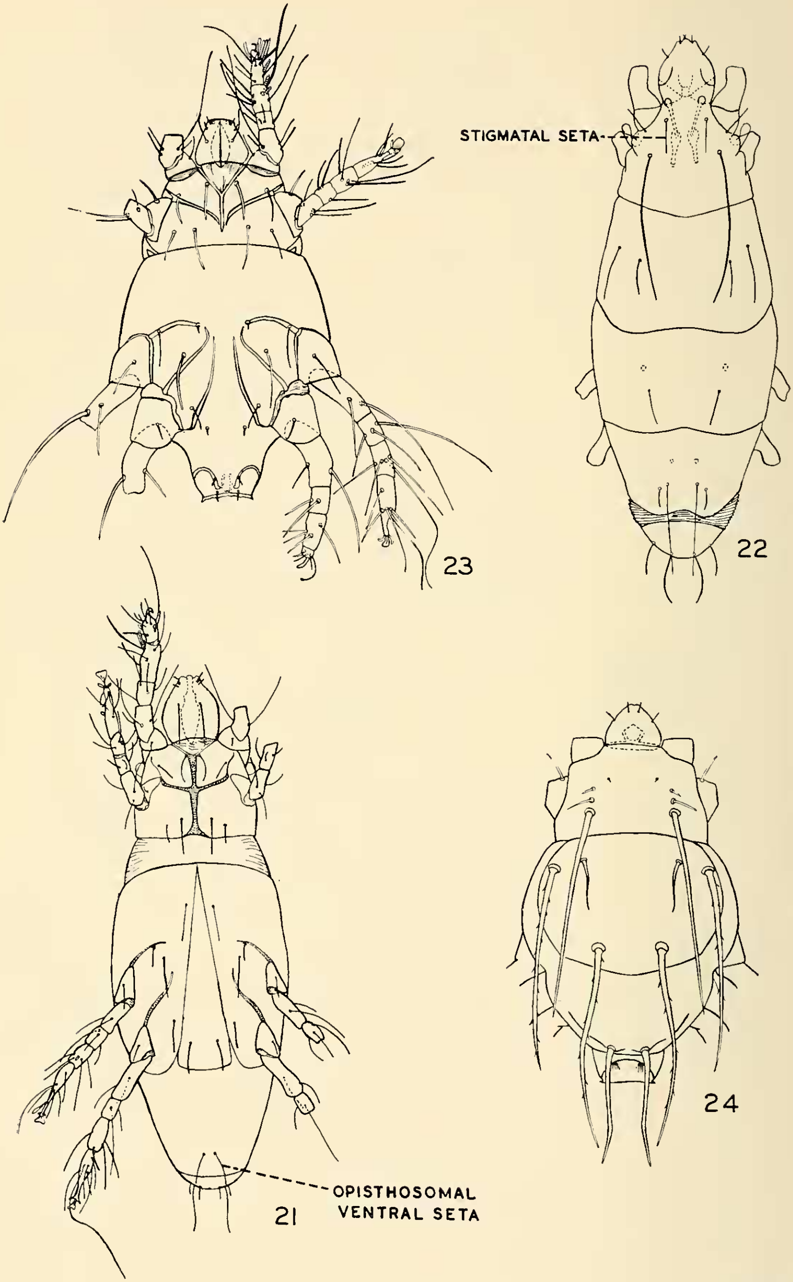
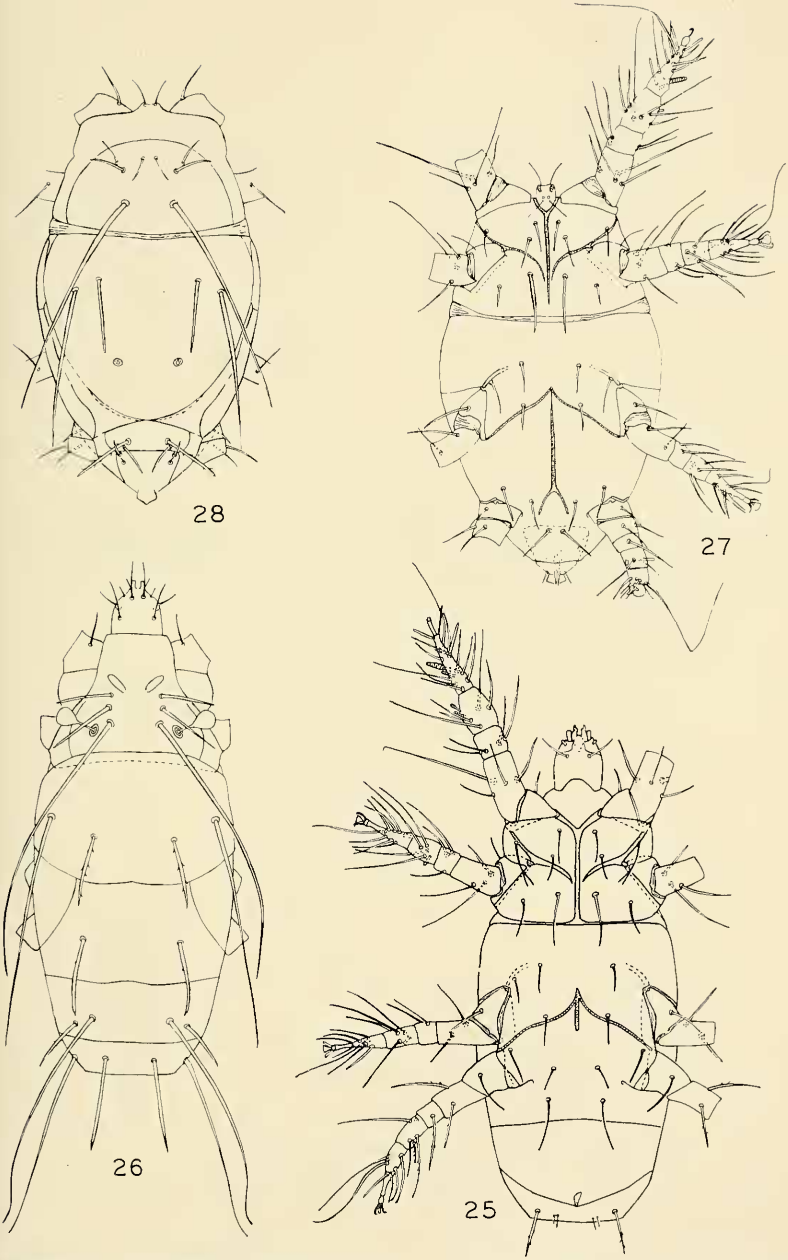
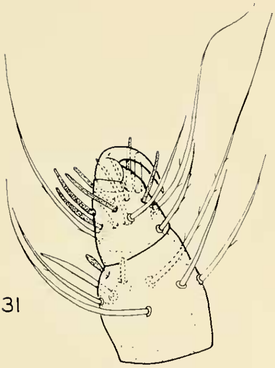


FIGS. 21-24. *Pyemotes* sp. (*near ventricosus*). Arlington, Va., *ex* wasp nest. Figs. 21-22, female. Figs. 23-24, male.



FIGS. 25-28. *Siteroptes* (*Siteroptes*) sp. (nr. *antiquissimus*). Figs. 25-26, female. Figs. 27-28, male.

FIGS. 29-34. *Trochometridium tribulatum,* holotype female. Figs. 31-34, right tibiae and tarsi of legs I, II, IV, III, respectively, ventral aspect.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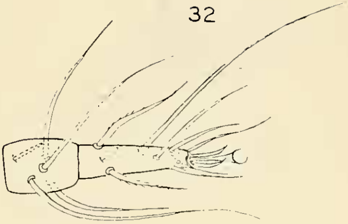
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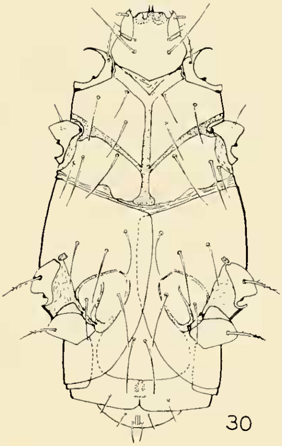
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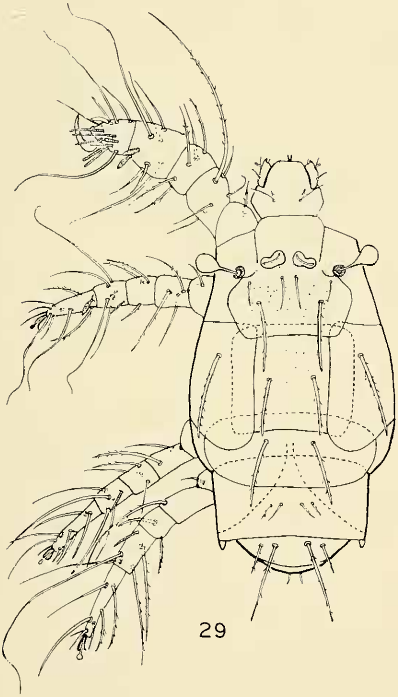
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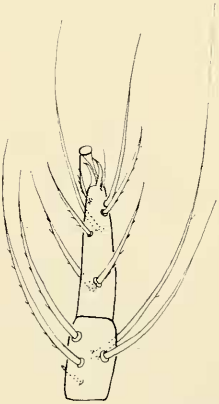
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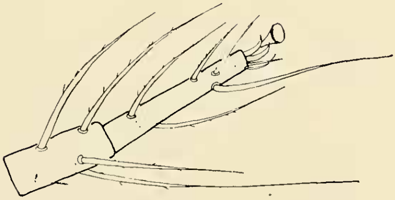
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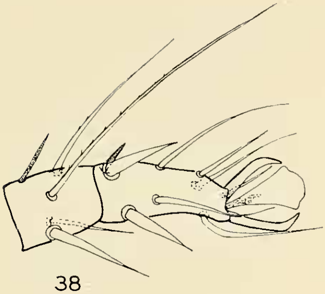
FIGS. 35-40. *Trochometridium tribulatum,* allotype male. Figs. 37-40, right tibiae and tarsi of legs I-IV, respectively, ventral aspect.



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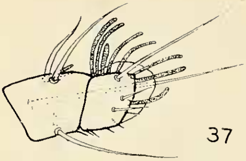

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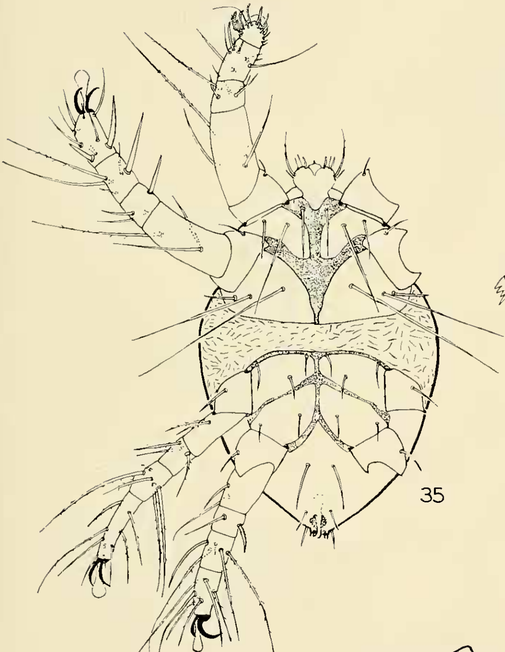

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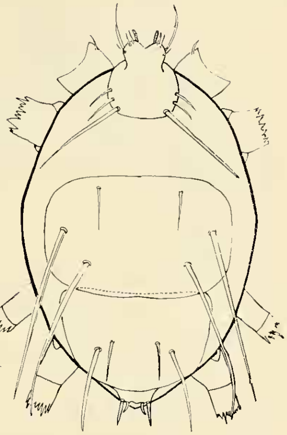

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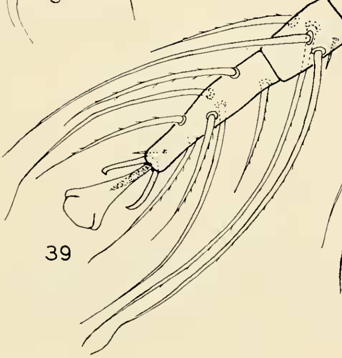

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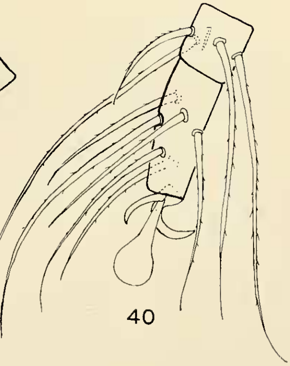

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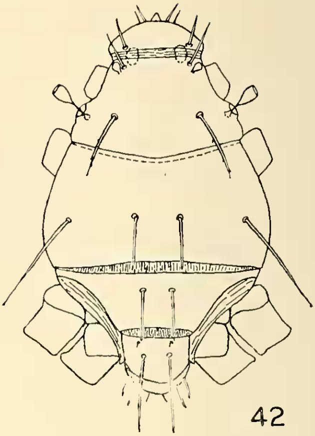

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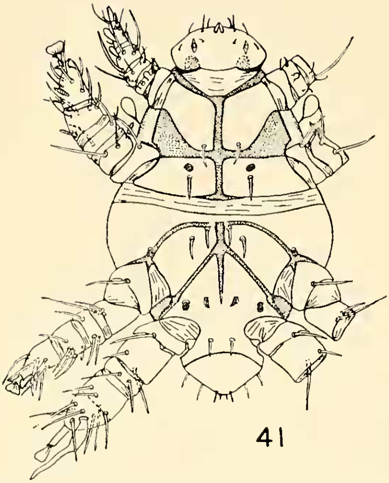

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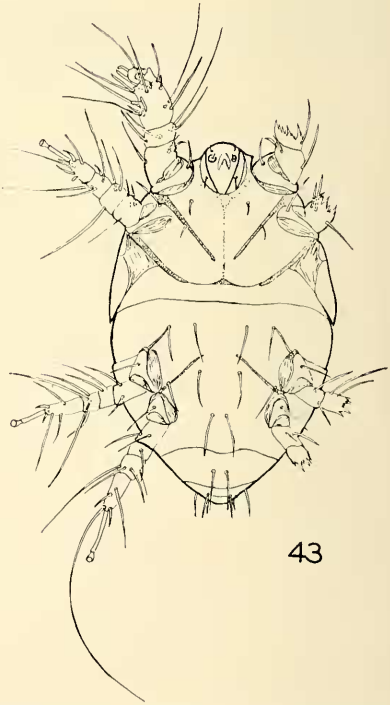

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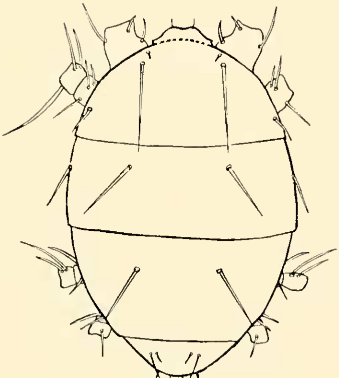

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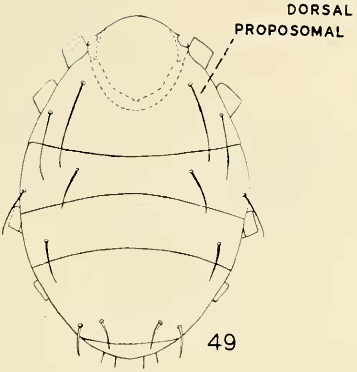
FIGS. 41-42. *Caraboacarus* sp. female, Lawrence, Kansas, from *Agonoderus* sp.

FIGS. 43-44. *Acarophenax tribolii,* female. India, jute bagging (taken at Puerto Rico in quarantine).



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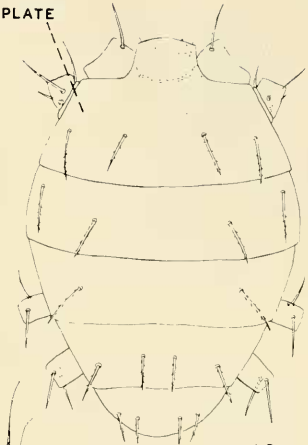

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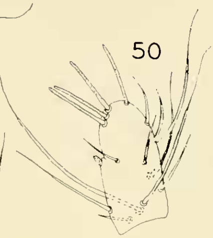

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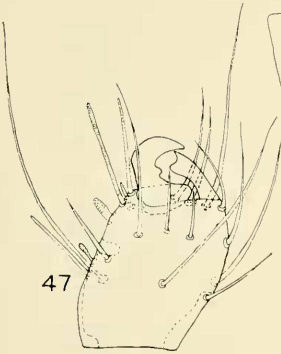

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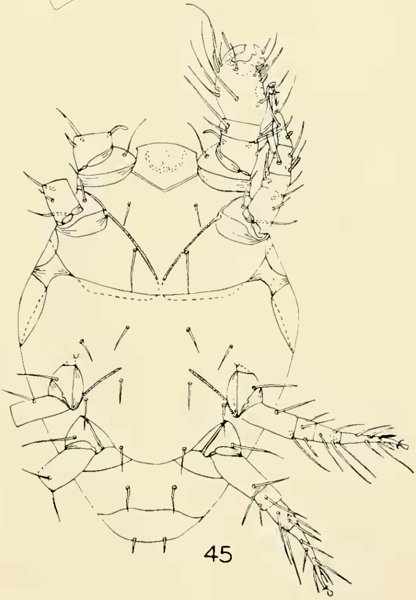

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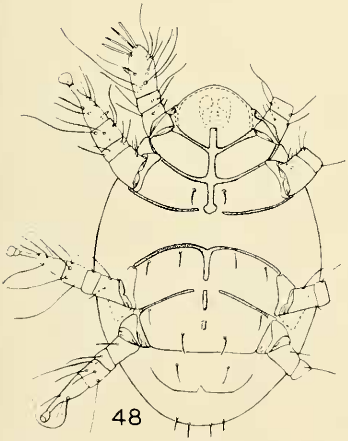

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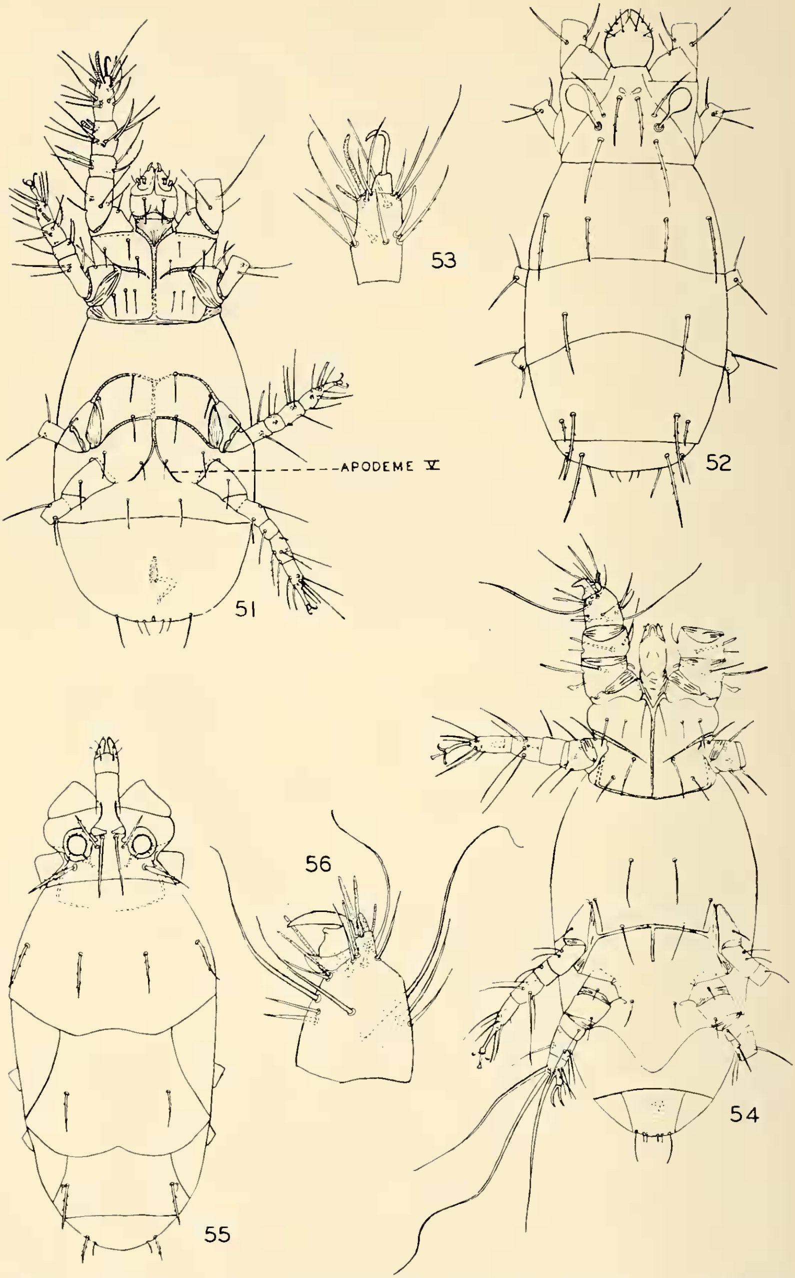
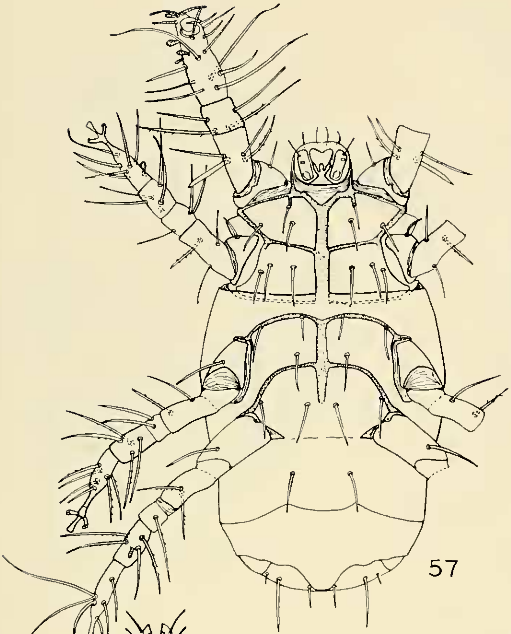
FIGS. 45-47. *Paracarophenax dybasi,* female. Composite, holotype and paratypes 1-3. Fig. 47, left tibiotarsus I, ventral aspect.

FIGS. 48-50. *Adactylidium beeri,* holotype female. Fig. 50, right tibiotarsus I, ventral aspect.



FIGS. 51-53. *Siteroptes* (*Siteroptoides*) *absidatus,* holotype female. Fig. 53, right tibiotarsus I, ventral aspect.

FIGS. 54-56. *Pediculaster* (*Acarothorectes*) *curculionium,* holotype female. Fig. 56, right tibiotarsus I, ventral aspect.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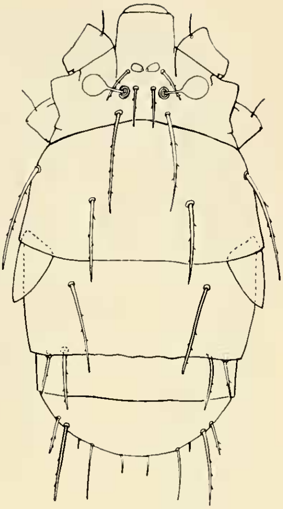
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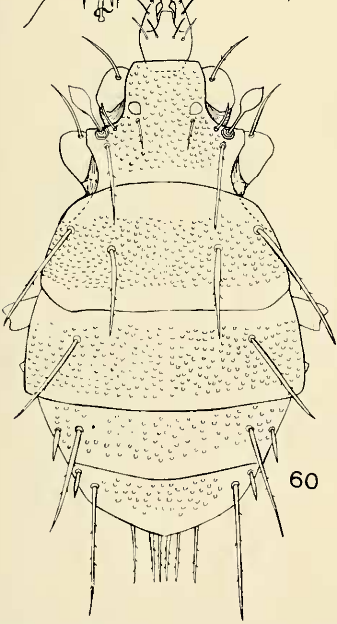
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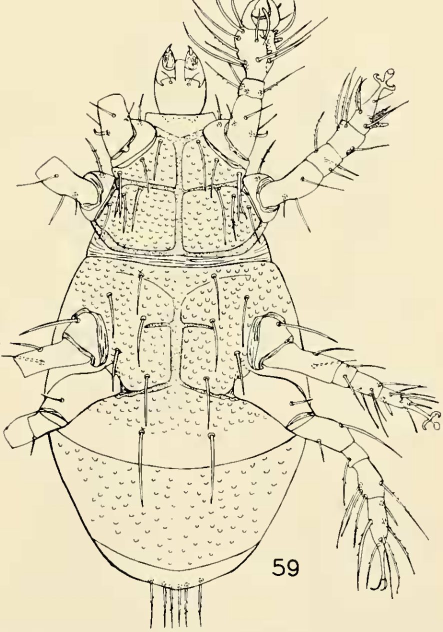
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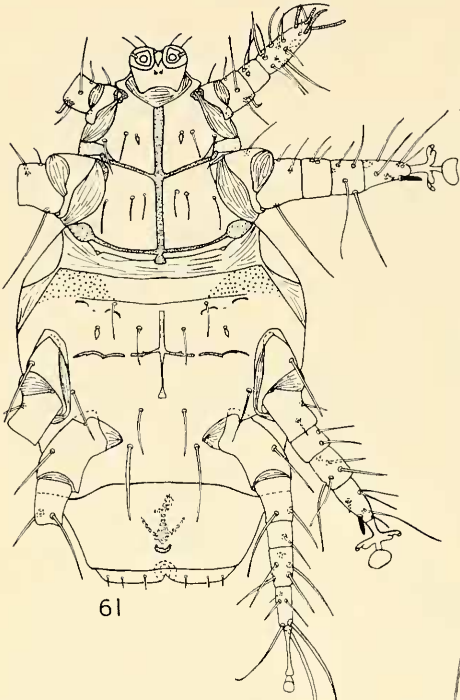
FIGS. 57-58. *Pediculaster* (*Pediculaster*) *americanus*, female. Composite, lectotype and paratype no. 1.

FIGS. 59-60. *Pygmephorus* sp. nr. *spinosus*, female, Posey Co., Indiana, from nest of *Blarina brevicauda*.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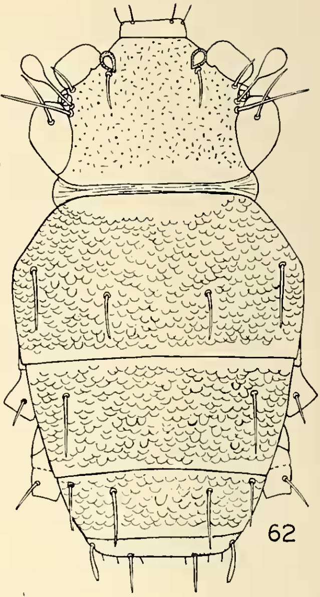
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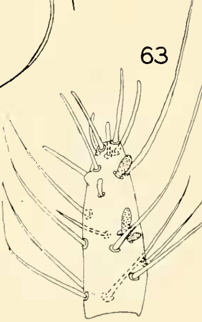
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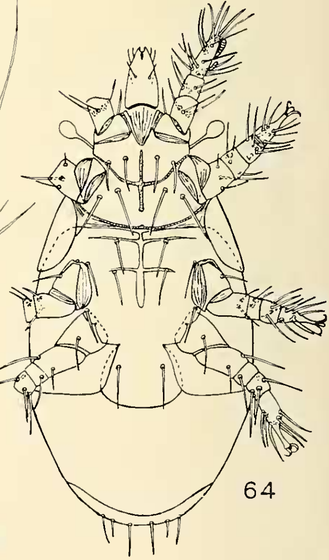
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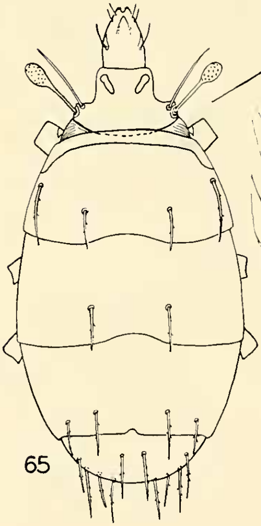
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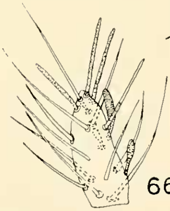
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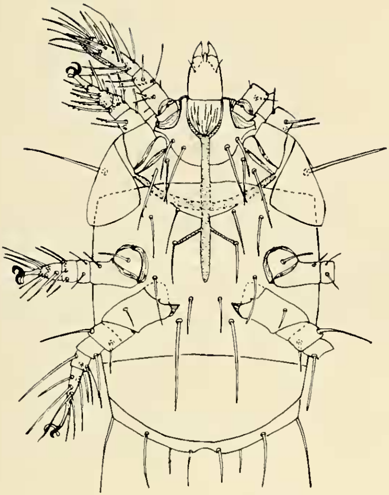
FIGS. 61-63. *Microdispodides pholidotus*, female. Composite, holotype and paratype no. 1. Fig. 63, right tibiotarsus I of holotype, dorsal aspect.

FIGS. 64-66. *Microdispus* (*Premicrodispus*) *chandleri*, holotype female. Fig. 66, left tibiotarsus I, ventral aspect.



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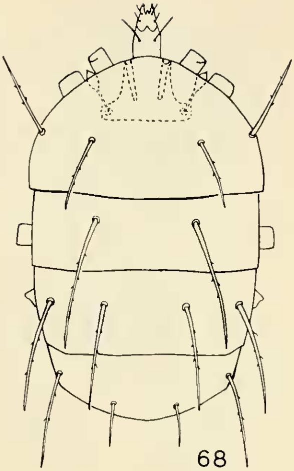

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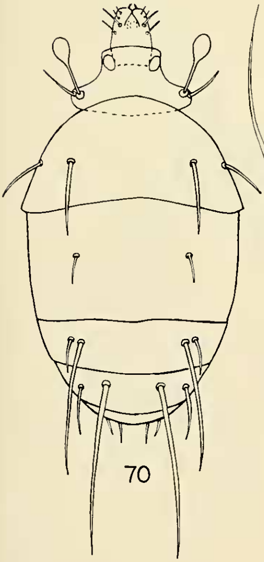

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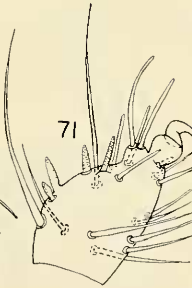

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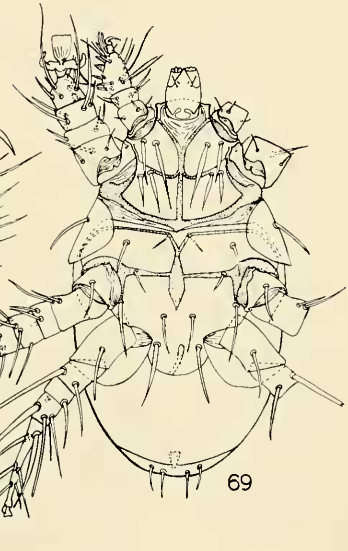

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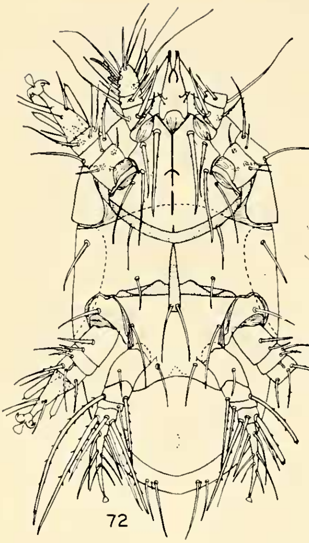
FIGS. 67-68. *Microdispus* (*Microdispus*) sp. female, Rio Caraguata, Matto Grosso, Brazil.

FIGS. 69-71. *Myrmecodispus dorylinis*, holotype female. Fig. 71, left tibiotarus I, dorsal aspect.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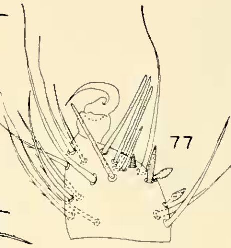
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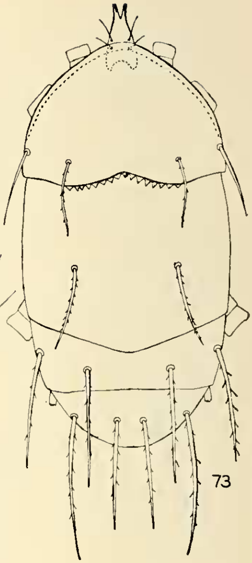
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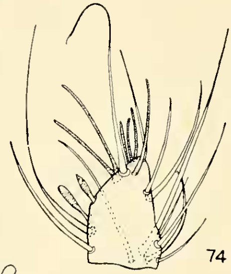
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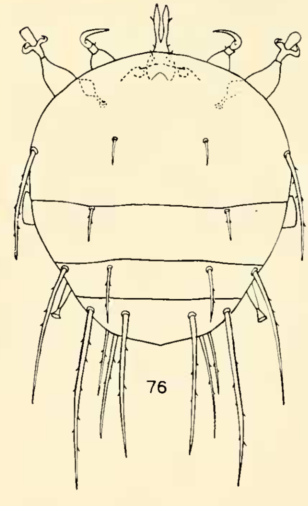
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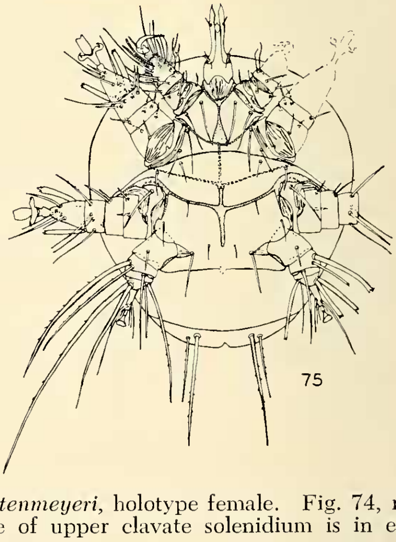
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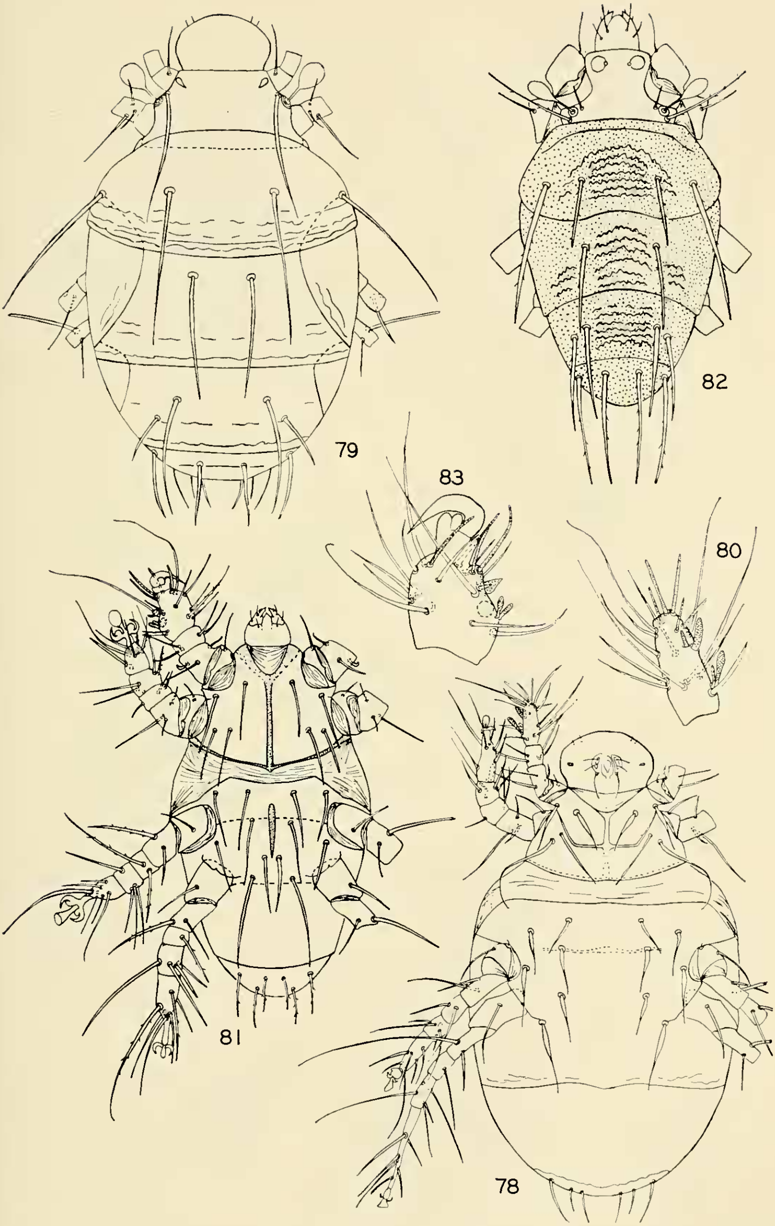
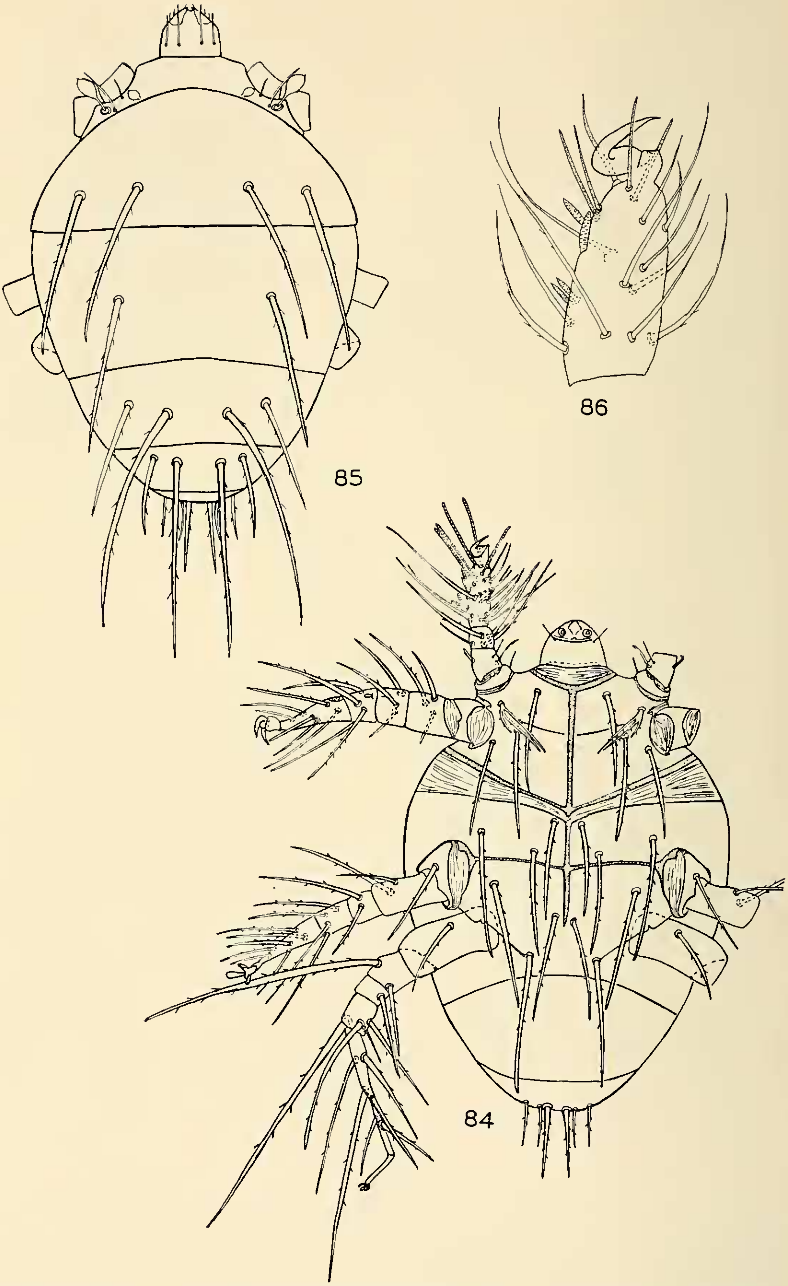
FIGS. 72-74. *Glyphidomastax rettenmeyeri,* holotype female. Fig. 74, right tibiotarsus I, ventral aspect. Shape of upper clavate solenidium is in error, see description.

FIGS. 75-77. *Perperipes ornithocephala,* female. Composite, holotype and paratype no. 12. Fig. 77, right tibiotarsus I of holotype, dorsal aspect.

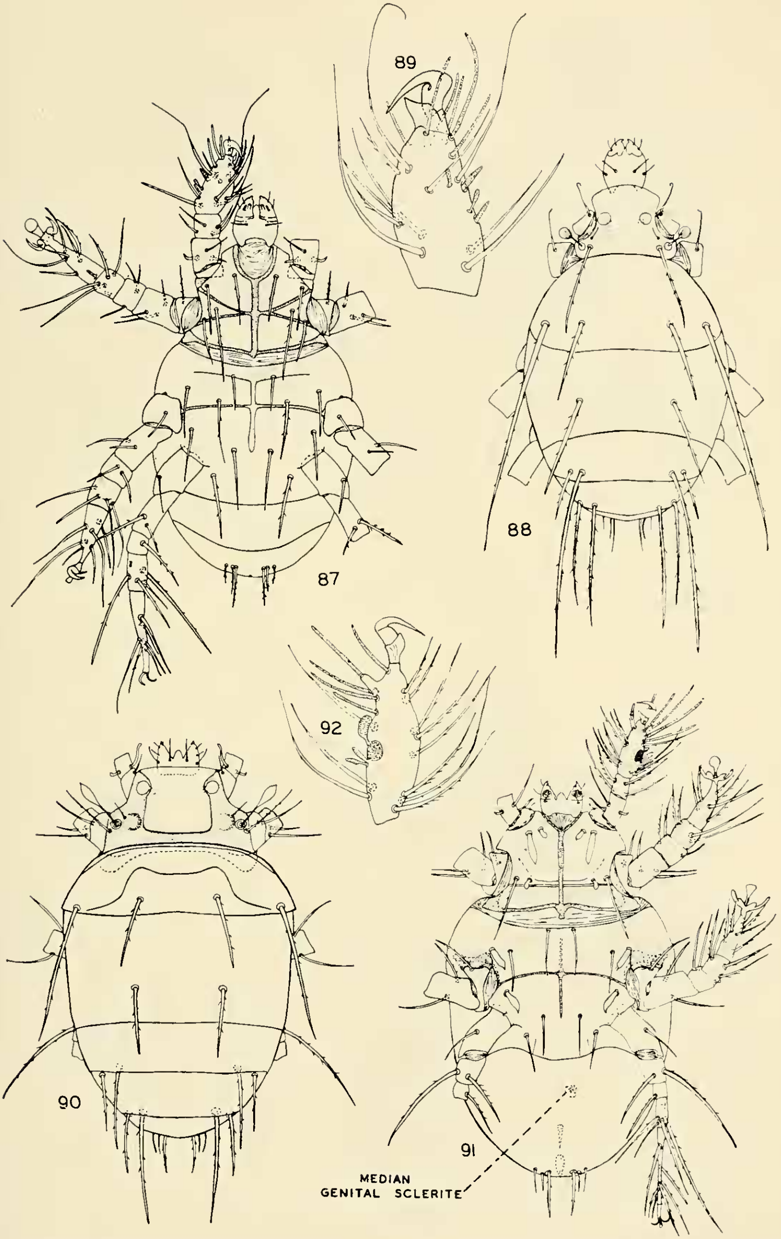


FIGS. 78-80. *Peponocara cathistes,* holotype female. Fig. 80, right tibiotarsus I, dorsal aspect.

FIGS. 81-83. *Parapygmephorus (Sicilipes) halictinis,* holotype female. Fig. 83, left tibiotarsus I, ventral aspect.

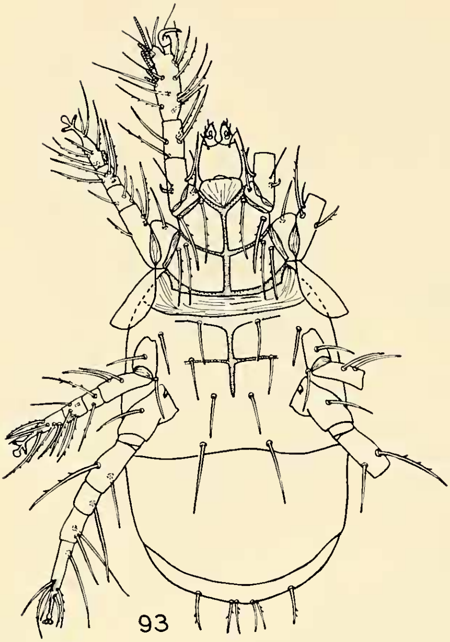


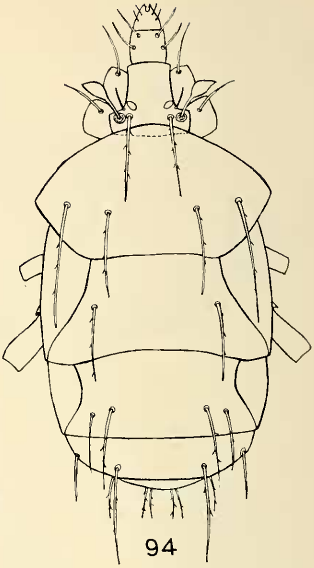
FIGS. 84-86. *Parapygmephorus* (*Petalomium*) *krczali*, female. Composite, holotype and paratype no. 2. Fig. 86, right tibiotarsus I of paratype no. 1, dorsal aspect.

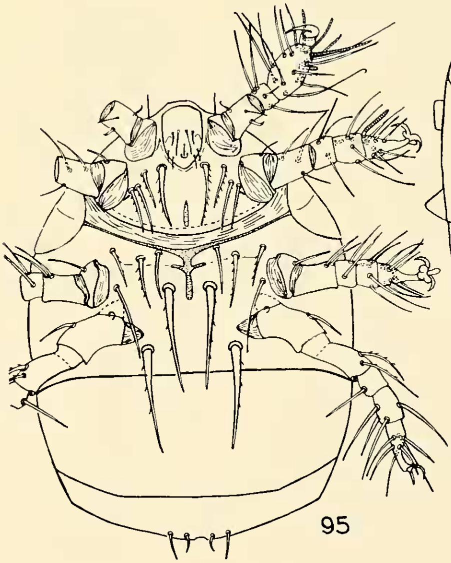


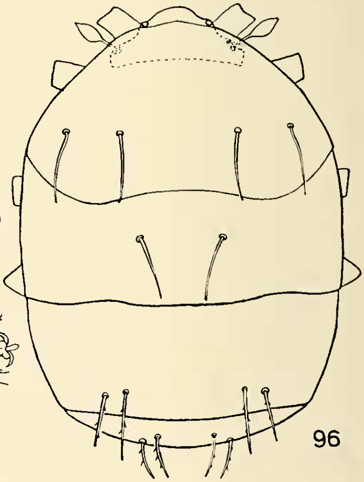
FIGS. 87-89. *Parapygmephorus* (*Parapygmephorus*) *natalensis,* female. Composite, holotype and paratype no. 2. Fig. 89, right tibiotarsus I of holotype, dorsal aspect.

FIGS. 90-92. *Acinogaster marianae,* holotype female. Fig. 92, left tibiotarsus I, dorsal aspect.



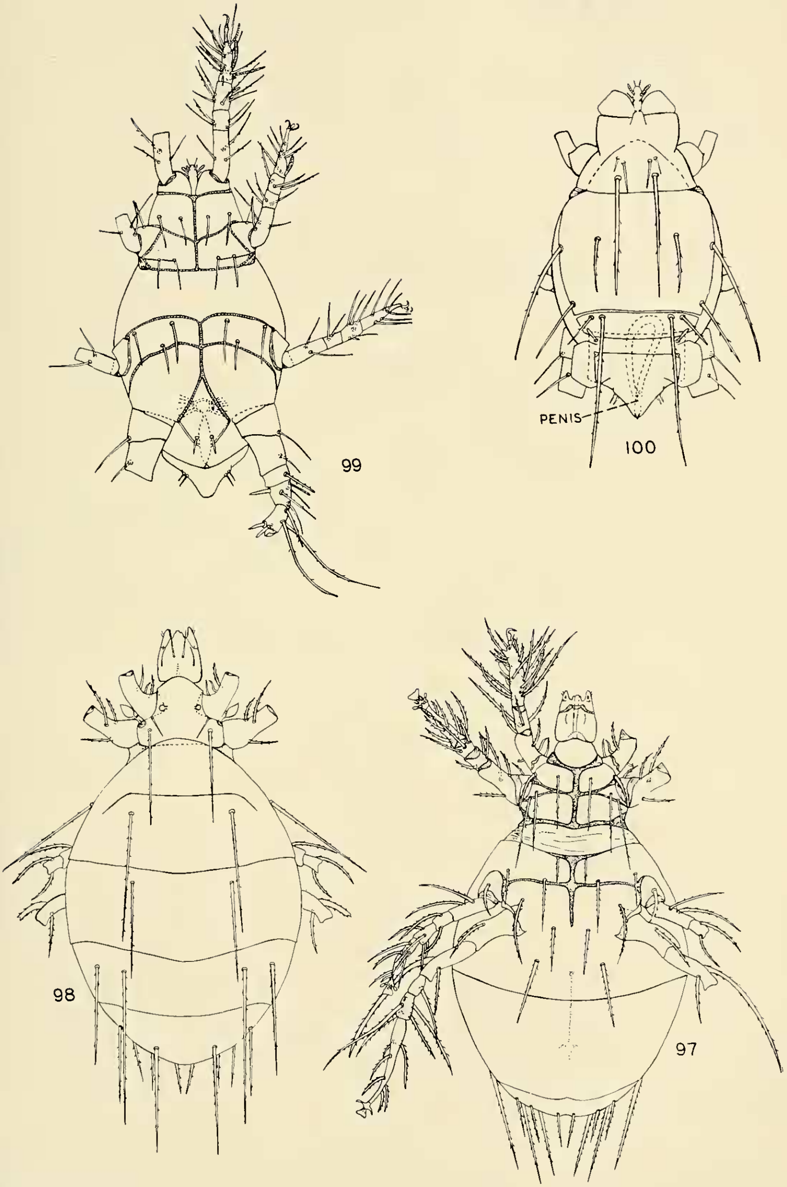






FIGS. 93-94. *Pseudopygmephorus* sp. nr. *tarsalis*, female, Lawrence, Kansas, leaf mold.

FIGS. 95-96. *Neopygmephorus* (*Allopygmephorus*) sp. nr. *matthesi*. Female, Muscotah, Kansas, from *Paracymus* in water.



FIGS. 97-100. *Neopygmephorus* (*Neopygmephorus*) sp. Lawrence, Kansas, in rodent cache under log. Figs. 97-98, female. Figs. 99-100, male.